

FAA Safety

BRIEFING

March/April 2015

Your source for general aviation news and information

Weather FORCES, SOURCES, and RESOURCES

Air Masses and Fronts — The Movers and Shakers of Weather, p. 8

Cloud-Spotting — Reading the Signposts of the Sky, p. 18

I've Got Weather — Now What Do I Do with It?, p. 26



Federal Aviation
Administration

faa.gov/news/safety_briefing
@FAASafetyBrief

The March/April 2015 issue of FAA Safety Briefing focuses on weather forces, sources, resources. Articles review some basic causes of weather activity, how certain conditions can affect pilot safety, and the tools you can use to aid your weather decision-making process.

16

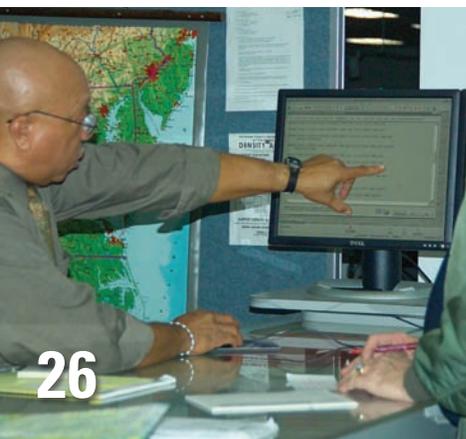
12



23



26



Features

- 8 Air Masses and Fronts**
The Movers and Shakers of Weather
by Tom Hoffmann
- 12 Getting Cross-eyed with Crosswinds and Turbulence**
The Effects of Turbulent Conditions on GA Pilots
by Steve Sparks
- 16 Cloud Dancing and Thunder Singing**
Developing Strategies to Avoid Inadvertent Peril
by James Williams
- 18 Cloud Spotting** Reading the Signposts of the Sky
by Paul Cianciolo
- 23 Hot, High, and Heavy** Beware the Deadly Density Altitude Cocktail
by Paul Cianciolo
- 26 I've Got Weather** (... Now What Do I Do with It?)
by Susan Parson
- 31 Developing Your Personal Minimums** Worksheet
by Susan Parson

Departments

- 1 Jumpseat** – an executive policy perspective
- 2 ATIS** – GA news and current events
- 5 Aeromedical Advisory** – a checkup on all things aeromedical
- 7 Ask Medical Certification** – Q&A on medical certification issues
- 22 Checklist** – FAA resources and safety reminders
- 25 Nuts, Bolts, and Electrons** – GA maintenance issues
- 33 Angle of Attack** – GA safety strategies
- 34 Vertically Speaking** – safety issues for rotorcraft pilots
- 35 Flight Forum** – letters from the Safety Briefing mailbag
- 36 Postflight** – an editor's perspective
- Inside back cover FAA Faces** – FAA employee profile

R-E-S-P-E-C-T

Over the years, it's been my privilege to live and fly all over our great country. That means that I've also had the opportunity to experience — or, in some cases, studiously avoid — almost every kind of weather Mother Nature can generate. Through my work, especially during my days as a Flight Standards District Office aviation safety inspector, I have also had the sad opportunity to witness the tragic outcome of pilot encounters with weather that could, or should have been avoided. The sobering reality is that weather is the most lethal of all major causes of GA accidents. In fact, the Aircraft Owners and Pilots Association (AOPA) reports that nearly 65 percent of weather-related accidents are fatal.

The good news is that we pilots have a great deal of power to prevent weather-related accidents. That's why we have chosen to focus this start-of-the-flying-season issue of *FAA Safety Briefing* magazine on Weather Forces, Sources, and Resources. You'll find all kinds of helpful information in these pages, from a review of basic meteorological phenomena to practical tips on how to analyze and apply that knowledge to specific flights, and how to develop individual personal minimums.

While I'm on the subject of weather resources, let me also offer a quick recap of an important weather safety effort. As you may know, the FAA and our aviation industry partners recently wrapped up a year-long "Got Weather" campaign to put the spotlight on just a few of the tips and techniques that our nation's 188,000 GA pilots can use to make better, safer weather decisions. In case you missed them, I've included links to each month's topic at the end of this column. And, though the official "Got Weather" campaign has ended, let me stress that the weather never stops — which means that respect for weather is also a never-ending obligation for those of us who fly.

R-E-S-P-E-C-T

Speaking of respect ... let me use this word as a mnemonic to help you remember just a few of the things you can do to enhance your weather wisdom and ensure a safe flying season:

Review. Review your own currency and proficiency and remember that they aren't necessarily the same. Make an honest assessment of your experience and comfort level for flying in marginal weather.

Educate. Education on weather never stops. Learn as much as you can about weather. How do you get weather information? What can you learn about weather? Have you reviewed weather minimums?

Share. Share what you know: make PIREPs to let other pilots know about the weather conditions you encounter, both good and bad. Your fellow pilots will appreciate knowing not only the areas to avoid, but also the "GA-friendly" altitudes and locations.

Plan. Plan for the worst. Have a plan — including an escape or diversion plan — for every flight that involves possible encounters with adverse weather. Planning also includes using the tips in this issue to develop or update your personal minimums.

Exercise. Exercise your skills on a regular basis, and remember that proper practice makes perfect. Take a safety pilot, or periodically hire a qualified instructor to make sure your skills stay sharp.

Communicate. Communicate your experience and best practices and encourage other pilots to do the same. Talk to fellow pilots, family, and friends about weather decision-making wherever you are; on the ramp or even at the airport restaurant.

Train. Training is always a good idea. In fact, a good pilot never stops learning and training, especially when it comes to aviation weather. While we're on the subject of training, is this the year to go after that new certificate, rating, or endorsement?

Follow these links to review each of the specific Got Weather topics:

May 2014 – Turbulence: <http://go.usa.gov/Jh4V>

June 2014 – Summertime Flying:
<http://go.usa.gov/Jh4H>

July 2014 – Flying IFR: <http://go.usa.gov/Jh2k>

August 2014 – Inadvertent IMC:
<http://go.usa.gov/Jh2P>

September 2014 – Pre-flight Weather:
<http://go.usa.gov/JhTC>

October 2014 – Icing: <http://go.usa.gov/JhTR>

November 2014 – Crosswinds: <http://go.usa.gov/Jhb3>

December 2014 – PIREPS: <http://go.usa.gov/JhbJ>



GA on NTSB's Most Wanted List

The National Transportation Safety Board (NTSB) recently issued its annual Most Wanted List of transportation safety improvements. Among the focus items outlined was loss of control issues for general aviation (GA). According to its online fact sheet, the NTSB states that between 2001 and 2011, more than 40 percent of fixed wing GA fatal accidents occurred because pilots lost control of their airplanes.

A point of emphasis on how to address this concern is for pilots to fully understand aerodynamic stalls, including how to recognize them and how to avoid conditions that could lead to a stall. Pilots are also encouraged to seek training to ensure that they understand how elements such as weight, center of gravity, turbulence, maneuvering loads, and other factors can affect an airplane's stall characteristics.

For more details on this and the other items that made the NTSB Most Wanted List, visit www.ntsb.gov/mostwanted.

and Upcoming in Airman Testing” section that will feature many new items in the near future, including information on the industry-developed Airman Certification Standards (ACS) and an updated sample test for the private pilot airplane knowledge exam.

Rotorcraft Safety Takes Center Stage at FAA-Hosted Conference

In an effort to explore ways to improve rotorcraft flight safety, the FAA's Rotorcraft Directorate will host a three-day safety forum April 21-23, 2015, at the Hurst Conference Center, just outside of Fort Worth, Texas. The conference will focus on the personal/private, instructional/training, and aerial application industries, which have accounted for about 57 percent of all accidents in the United States over the past five years.

The first day of the conference will include presentations by National Transportation Safety Board member Robert Sumwalt, survivors of helicopter accidents or near-accidents, and an FAA-led discussion on the patterns seen in fatal helicopter accidents. Participants will also be able take part in breakout sessions; pilots will discuss autorotations, and health and risk assessments, while mechanics will discuss NextGen technology installation, human factors in maintenance, supplemental type certificates, and a planned aviation data exchange tool. The conference will conclude with an “International Day” that will include presentations from the European Aviation Safety Agency, Transport Canada Civil Aviation, industry groups, and the FAA. There will also be a job fair onsite along with rooms for meetings and networking.

Registration for the event is easy. Just visit www.faaahelisafety.org and click on the registration button. For more information, email Gene Trainor, conference publicity manager, at eugene.trainor@faa.gov.



Photo courtesy of NTSB

Updated FAQ Available on Airman Testing

For the latest information on airman testing, check out the completely revamped frequently asked questions document on the FAA's Airman Testing page at www.faa.gov/training_testing/testing/. The FAQs are presented in terms of three main topics: certification, training, and testing with easy-to-navigate hyperlinks. The Airman Testing page also includes a link to submit an airman knowledge test question idea, as well as a link to submit general feedback. At the bottom of the page is a “What's New

New NOTAM Search Features Available

To help pilots streamline their search for Notices to Airmen (NOTAMs) during flight planning, the FAA rolled out some new search features now available at <http://notams.aim.faa.gov/notamSearch/>. Among the new features is a “search by flight path” capability that allows pilots to see NOTAMS that apply only to the route they custom select using airports, navigational aids, named fixes, and/or route/airway designators to define a flight path. That flight path width can also be adjusted from one to 125 nautical miles

on each side and NOTAMs for up to five alternate airports can also be included. The “search by free text” feature allows you to search for NOTAMs based on a keyword, airport designator, NOTAM number or scenario. Search results can also be custom sorted by location, number, class, start and end dates, and condition. Users can also export search results to a Microsoft Excel or Adobe PDF document. Additional enhancements to search capability are expected in the near future.

For more on how to use the search function, click the “help” button at the top right of the NOTAM Search home page to access a user’s guide. Feedback is also encouraged to help make improvements. Next to the help link is a feedback button where you can submit comments.

Human Factors in Aviation Maintenance

In 2005, the FAA worked with industry to publish the *Operator’s Manual for Human Factors in Aviation Maintenance*. The manual earned broad U.S. and international acceptance, which included a Spanish and Chinese translation. The document design, simplicity, and concise delivery of technical information were the key features that made it so useful for maintenance and engineering personnel. An updated edition has now been released.

The second edition of *The Operator’s Manual for Human Factors in Aviation Maintenance* follows the same successful format as the first edition with

selected chapters being substituted with chapters more relevant to today’s aviation maintenance challenges. Repeated chapters are also significantly enhanced.

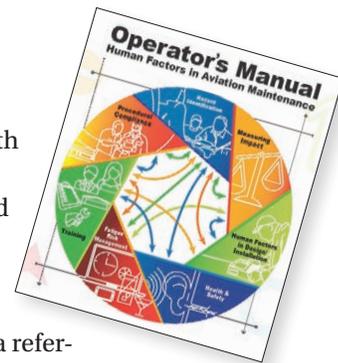
The manual is not designed to be read cover-to-cover, but rather used as a reference to overview and get specific implementation advice on the following seven topics:

1. Event Investigation and Voluntary Reporting
2. Procedural Compliance and Documentation
3. Human Factors Training Evolution
4. Fatigue/Alertness Management
5. Human Factors Health and Safety Programs
6. Considering Human Factors in Equipment and Installation
7. Measuring Impact and Return on Investment

Go to <http://1.usa.gov/1xyKt8y> to download the manual, which will be posted on the Aerospace Medicine Technical Reports page in February.

Update Your Moving Checklist

Just like your driver’s license when you move to a new home, airman certificate holders must also notify the FAA of any address changes. Title 14 Code of Federal Regulations (14 CFR), sections 61.60, 63.21, and 65.21 require that an airman certificate holder must update their mailing address within 30 days of moving.



Safety Enhancement Topics

March: Single Pilot CRM — How to manage a crew of just you.



April: Mountain Flying — Understanding the need for training and currency when flying in mountainous areas.



Please visit www.faa.gov/news/safety_briefing for more information on these and other topics.



U.S. Department
of Transportation

Federal Aviation Administration

ISSN: 1057-9648
FAA Safety Briefing
March/April 2015
Volume 55/Number 2

Anthony R. Foxx *Secretary of Transportation*
Michael P. Huerta *Administrator*
Margaret Gilligan *Associate Administrator for Aviation Safety*
John Duncan *Director, Flight Standards Service*
James Viola *Manager, General Aviation and Commercial Division*
Susan Parson *Editor*
Tom Hoffmann *Managing Editor*
James Williams *Associate Editor / Photo Editor*
Sabrina Woods *Associate Editor*
Paul Cianciolo *Assistant Editor*
Amy Ellis *Art Director*

Published six times a year, *FAA Safety Briefing*, formerly *FAA Aviation News*, promotes aviation safety by discussing current technical, regulatory, and procedural aspects affecting the safe operation and maintenance of aircraft. Although based on current FAA policy and rule interpretations, all material is advisory or informational in nature and should not be construed to have regulatory effect. Certain details of accidents described herein may have been altered to protect the privacy of those involved.

The FAA does not officially endorse any goods, services, materials, or products of manufacturers that may be referred to in an article. All brands, product names, company names, trademarks, and service marks are the properties of their respective owners. All rights reserved.

The Office of Management and Budget has approved the use of public funds for printing *FAA Safety Briefing*.

CONTACT INFORMATION

The magazine is available on the Internet at:
http://www.faa.gov/news/safety_briefing

Comments or questions should be directed to the staff by:

- Emailing: SafetyBriefing@faa.gov
- Writing: Editor, *FAA Safety Briefing*, Federal Aviation Administration, AFS-805, 800 Independence Avenue, SW, Washington, DC 20591
- Calling: (202) 267-1100
- Twitter: @FAASafetyBrief

SUBSCRIPTION INFORMATION

The Superintendent of Documents, U.S. Government Printing Office, sells *FAA Safety Briefing* on subscription and mails up to four renewal notices.

For New Orders: Subscribe via the Internet at <http://bookstore.gpo.gov>, telephone (202) 512-1800 or toll-free 1-866-512-1800, or use the self-mailer form in the center of this magazine and send to Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9371.

Subscription Problems/Change of Address: Send your mailing label with your comments/request to Superintendent of Documents, U.S. Government Printing Office, Contact Center, Washington, DC 20408-9375. You can also call (202) 512-1800 or 1-866-512-1800 and ask for Customer Service, or fax your information to (202) 512-2104.

For further instructions and to update your address online, go to <http://1.usa.gov/1wDeOWr>.

It's also a good idea to change the location setting in your www.faa.gov profile so you don't miss out on being notified about safety seminars and other events in your new area.

Helicopter Handbook

The *Helicopter Flying Handbook* (<http://1.usa.gov/1AMLOw0>) was published in 2012, and as with any publication, there are bound to be corrections and/or changes that need to be brought to the attention of the flying public. The HFH corrections are posted in an errata sheet available online at <http://1.usa.gov/1z7pmj6>.



The errata sheet information is critical since it corrects minor errors and supplements the existing document. It is recommended that you print out the current errata sheet and staple it to the inside front cover of the HFH for future reference.

Also, if you discover an error in the HFH, please email a description of the error to AFS630comments@faa.gov.

New AMT Course Helps Mechanics PAUSE for Safety

A new online course that reviews and promotes maintenance human factors is now available on the FAA Safety Team website (www.FAASafety.gov). Titled "PAUSE for Safety," this course will review some of the human factors issues that maintenance technicians experience and explain why following procedures, policies, instructions, regulations, and best practices is the safety keystone for aviation maintenance.

The course will also present the new PAUSE tool, a maintenance human factors tool that AMTs can put to use immediately. This new tool will allow you to improve your maintenance situational awareness and help prevent you from becoming a victim of a maintenance incident or accident scenario.

The "PAUSE for Safety" course is required and must be completed before Jan. 1, 2016, in order to participate in the FAA's 2015 on-line AMT Awards program, a program that encourages AMTs and employers to take advantage of initial and recurrent training. Visit www.faa.gov/AMT/amtinfo for more on the program. The course can also be used for one hour of accepted training toward Inspection Authorization (IA) renewal in accordance with 14 CFR part 65.

Walking Away

Many of you probably saw the reports over this past holiday season of a young girl who survived an aircraft crash with only minor injuries. This accident serves as a reminder that many GA accidents are actually survivable. This is an area of great interest to those of us in the aviation safety business. While we would rather that accidents didn't happen at all, making them more survivable is another way of saving lives and letting more pilots (and passengers) walk away from a mishap.

On that note, I had the pleasure of being on hand to help reopen a facility that FAA hopes will contribute to making more GA and commercial accidents survivable; the Civil Aerospace Medical Institute's (CAMI) Van Gowdy Research Test Track.

A Different Kind of Sledding

The Van Gowdy Research Test Track is a new impact test facility featuring a computer-operated sled on a 110-foot track that runs more efficiently and at higher acceleration levels than the track it replaces. This allows CAMI researchers to obtain data that will eventually help improve aircraft accident survivability. The main research application is to improve the crash safety provided by aircraft seats and restraint systems.

Impact tests are conducted using an accelerator-type sled system. Test specimens are mounted on a sled that is propelled along precision rails by a pneumatic cylinder and controlled by a servo hydraulic brake system. This system can accurately reproduce the high frequency/high G accelerations that occur during survivable aircraft crashes. Any impact vector can be replicated by adjusting the orientation of the test article on the sled. During impact tests, the seats are occupied by instrumented anthropometric test devices (ATDs), or what we used to call "crash test dummies," ranging in size from a 1-year-old child to a 95th percentile (very large) man. Accelerations, forces, and deflections measured inside the ATDs during a test are recorded on a multi-channel, high-speed data acquisition system and evaluated to determine the risk of injury.

This facility upgrade also included high-speed high-resolution cameras that can capture up to 1,000 frames per second. Additionally, the upgrade included installation of high intensity lighting to allow the high-speed cameras to better capture images. The higher payload capacity of the new sled allows larger scale experiments, like multiple rows of

first class or pod airline seats, or sections of fuselage from small- to medium-size aircraft. Another potential area of advancement is emulating actual crash pulses. The high frequency response of the new sled permits an accurate emulation of impact conditions observed during full-scale impact tests. This allows improved seat and restraint systems to be directly compared to the performance demonstrated during baseline full-scale impact tests. All of these improvements mean better and more accurately recorded data which can lead to better safety standards.

What's on the Horizon?

The FAA Aviation Safety Organization and the Transport, Rotorcraft, and Small Airplane Directorates are working with CAMI to identify and prioritize the research projects conducted. Research findings based on CAMI sled test results are often referred to by these rule making organizations when developing or creating new safety requirements. The findings are also referenced by industry organizations such as the SAE International and the American Society of Mechanical Engineers (ASME) when formulating new safety standards. CAMI often supports investigations by the FAA's Office of Accident Investigation and Prevention and the National Transportation Safety Board.

CAMI is looking to test subjects like: rotorcraft energy absorbing seats, rotorcraft seat cushion evaluation, ATD development, and large payload tests. The new system has exceptional repeatability built in which allows researchers to build data sets quicker than previously possible. The system is literally state-of-the-art in crash simulation. Similar systems have been installed at some universities and companies in the United States and at several companies outside the U.S., but no other U.S. government lab has similar capabilities.

With these new tools, CAMI researchers are hoping to contribute to many more pilots and passengers walking away from aviation accidents.

James Fraser received a B.A., M.D., and M.P.H. from the University of Oklahoma. He completed a thirty year Navy career and retired as a Captain (O6) in January 2004. He is certified in the specialties of Preventive Medicine (Aerospace Medicine) and Family Practice. He is a Fellow of the Aerospace Medical Association and the American Academy of Family Practice.

Fast-track Your Medical Certificate

With FAA MedXPress, you can get your medical certificate faster than ever before.

Here's how: Before your appointment with your Aviation Medical Examiner (AME) simply go online to FAA MedXPress at <https://medxpress.faa.gov/> and electronically complete FAA Form 8500-8. Information entered into MedXPress will be available to your AME to review prior to and at the time of your medical examination, if you provide a confirmation number.

With this online option you can complete FAA Form 8500-8 in the privacy and comfort of your home and submit it before your appointment.

The service is free and can be found at:

<https://medxpress.faa.gov/>



ATTENTION:
As of Oct. 1, 2012, pilots
must use MedXpress
to apply for a Medical
Certificate.





Ask Medical Certification

COURTNEY SCOTT, D.O.
MANAGER, AEROSPACE MEDICAL
CERTIFICATION DIVISION

Q1. In September 2012 I let my third class medical lapse while I sorted out the reasons for elevated blood pressure, which was identified simply during a couple workups for routine exams with my PCP and gastroenterologist. I found a cardiologist and went through an entire battery of diagnostic tests, and was deemed safe to fly with no foreseeable problems of a cardiac nature for 10 years into the future. I now take a single 40 mg tablet of Benicar daily. This controls my blood pressure. I also run 2.5 miles regularly and do not smoke or drink alcohol. I've decided to go back and get my third class medical, and would like to know what to expect from my medical examiner.

A1. Well-controlled hypertension is now considered a condition that your AME can certify. You should take with you evidence that your hypertension is well controlled, such as a series of three daily blood pressure checks, and a note from your treating physician that discusses your treatment regimen and whether or not you have any side effects.

Q2. What are the requirements for a person with a non-alcohol, non-drug related felony, who wishes to obtain a second- or third-class medical?

A2. We normally ask for court records. If prison time was required, we ask for those records as well. We also ask for a personal statement from the applicant describing his or her side of what happened. Depending on the case, we may ask for a psychological evaluation.

Q3. I am a CFI/CFII ASE. I currently have a special issuance third-class medical for controlled blood pressure and diabetes with meds. What is needed to move up to a second-class medical? I would like to use my commercial privileges.

A3: The only concern would be if the diabetes management requires insulin. At this time, we may only grant special issuance for third-class for airmen on insulin. All other medications for blood pressure and diabetes mellitus management that are acceptable for third-class would also be acceptable for second-class. All you need to do is to send a letter to the Aerospace Medicine Certification Division requesting a second-class medical certificate.

Q4. Is there an age limit on private pilot's licenses? What should be the limit, provided third-class reform is approved?

A4: There is no specific age limit on general aviation medical certificates. The third-class medical reform initiative will not change this. It is fair to say that, as we age, we tend to develop more disqualifying medical conditions, but there are no age limits, per se.

Send your questions to SafetyBriefing@faa.gov. We'll forward them to the Aerospace Medical Certification Division without your name and publish the answer in an upcoming issue.

Courtney Scott, D.O., M.P.H., is the Manager of Aerospace Medical Certification Division in Oklahoma City, Okla. He is board certified in aerospace medicine and has extensive practice experience in civilian and both military and non-military government settings.

GA SAFETY ON THE GO



Download the e-Reader File



faa.gov/news/safety_briefing



AIR MASSES AND FRONTS

The Movers and Shakers of Weather

BY TOM HOFFMANN

Who has ever heard the doorbell ring at an odd hour and felt a sense of trepidation? The anxiety grows as you creep towards the door and slowly peel back the curtain. Taken by surprise, you quickly muster your best “authentic” smile as you notice your in-laws waving feverishly from the front step. Oh, and look ... they brought your sister-in-law, Tootie, and her husband Randy, and their sweet two-year-old twin boys, too. You suppose the twins begin screaming because they’re just so darn excited to see you. Awesome. After removing the palm from your forehead, you open the door to joyously greet your new guests. Internally, you sigh as just about everything you had planned for the day has forever changed.

Just like the surprise guests at your doorstep, weather has a tricky tendency to show up unannounced and throw a continent-sized wrench in your plans. Ask any pilot who’s had to revert to a plan B mid-flight due to unexpected or deteriorating conditions (I suspect that covers about every pilot). Unfortunately, it’s a scenario all too common within the GA arena. And for those lacking the foresight of a contingency plan, it can also have deadly consequences (just see this issue’s *Angle of Attack*). So what can be done to help eliminate unwanted weather surprises from ruining your day? Given their monumental role in our ever-changing weather patterns, a look at the mechanics of air masses and fronts could provide some much-needed assistance. And who knows, maybe after reading this, Frank Fahrenheit’s seemingly vague forecast on the 11 o’clock news might provide more tactical information than you previously believed.

The Big Picture

During pre-flight weather planning, pilots are correct in wanting to focus on the local conditions and forecasts that affect their route of flight. However, it’s the bigger picture of weather that often gets a casual glance, or worse, overlooked altogether. Having a more “global” perspective can provide that extra bit of insight that leads to a more informed go/no-go decision or backup plan. When it comes to influencing our climate, it doesn’t get any more global than air masses and fronts — the true movers and shakers of weather on our planet. So let’s start with a review of what these two players are and how their actions (and interactions) could influence what you encounter on your next flight.

By definition, air masses are large bodies of air that take on the characteristics of their surrounding environment — namely temperature and humidity — with fairly uniform distribution. They form in certain source regions where air can remain stagnant for days at a time. The weather here in the United States is influenced by air masses formed in four regions (see fig. 1). We have the continental polar (cP) air mass that brings cold, dry air from Canada; the maritime polar (mP) air that brings in moist, cool air from the northwest and northeast oceans; the maritime tropical (mT) regions that bring warm, moist air from the Gulf of Mexico and southern oceans; and finally, the continental tropical (cT) air mass with hot, dry air that forms over Mexico and the southwest United States. There is also a fifth, somewhat infamous region that can also affect U.S. weather known as continental arctic (cA). The polar

vortex you heard so much about last year was exactly this, the cA air mass pushing down over parts of the United States causing a deep freeze that forced its way into the deep south.

On the Front Lines

Much like the aforementioned two-year old twins, air masses can get fidgety. You can attribute that motion to the sun's energy as it heats the air mostly around the equator. Once the air is heated, it rises and then flows back towards the poles. Conversely, the colder and denser air at the poles sinks and slides down back toward the equator. Throw in gravity, a planet that spins at over 1,000 mph, and a complete range of orographic features, and you've got yourself a hive of climate activity. All this energy is what impacts air mass movement and ultimately determines whether we need sunglasses or an umbrella to face the day.

As different air masses move around in the atmosphere, they inevitably collide and try to push each other around. It's a massive and often violent game of give and take. Where two or more different air masses clash is an area appropriately known as a front.

Fronts come in four different varieties: cold, warm, stationary, and occluded. As even a non-aviation sort would know from watching the evening news, cold fronts are denoted with blue spikey bands pointed in the direction of movement and form when an advancing cold air mass is replacing a warmer air mass. It might help to imagine the spikey points as giant shovels picking up the warmer air in front of it. The action can sometimes be dramatic, especially when there are large differences in temperature, pressure, and humidity. A good example — and the reason why we see such violent springtime weather across the Great Plains — is when cool, dry air from Canada smacks into the much warmer, humid air rising up from the south.

Common by-products of an advancing cold front include pronounced wind shifts and cloud creation. The type of cloud depends on the stability of the air mass in the frontal zone, but you can generally expect billowy cumulus, or its more stormy relative, cumulonimbus, if sufficient instability and moisture abounds. Cold fronts also move rapidly — around 25 to 30 mph in most cases — but some have been clocked at highway speeds of 60 mph! That might make you think twice about trying to outrun one of these weather-makers.

On The Warm and Fuzzy Side

On the opposite end, warm fronts are caused when an advancing warm air mass is replacing a colder air mass. Maps depict them with red, semi-circles, which you could envision as bubbles of warm air rising up

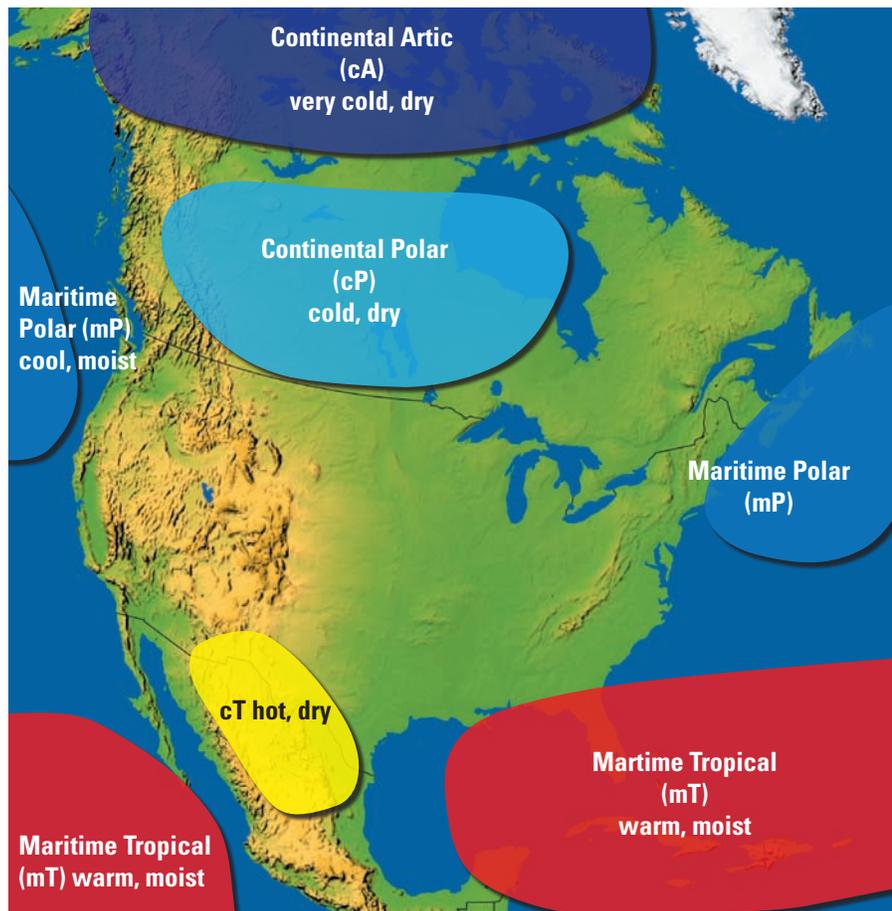


Fig. 1 - Map of air mass types and where they develop.

and displacing the cooler air in front of it. Warm fronts are slower than their colder cousins and less pronounced with regard to their overtaking action. There's usually more of a gentle slope as warmer and less dense air rides up over colder air. Because of this, the humidity in this warmer air condenses as it rises, causing more widespread areas of thick and soupy weather. In fact, clouds and rain can often precede the surface passage of a warm front by hundreds of miles — something a VFR-only pilot will want to watch out for. Your weather map may show a warm front over Missouri, but its IFR-inducing effects could already be several hundred miles east over central Kentucky.

Rounding out the four frontal types are stationary fronts and occluded fronts, which are a "hybrid" of a cold and warm front. In a stationary front, neither the cold nor the warm side has enough energy to replace the other. They both remain in sort of a stalled out pattern, sometimes for days, with resulting weather being a mixture of the two. While this may seem like a somewhat stable scenario, it's not uncommon for the edges of a stationary front to kink or bend and become a breeding ground for bad weather. When an upper level trough (or an area of lower pressure aloft) approaches a stationary front, the front will begin evolving into a frontal

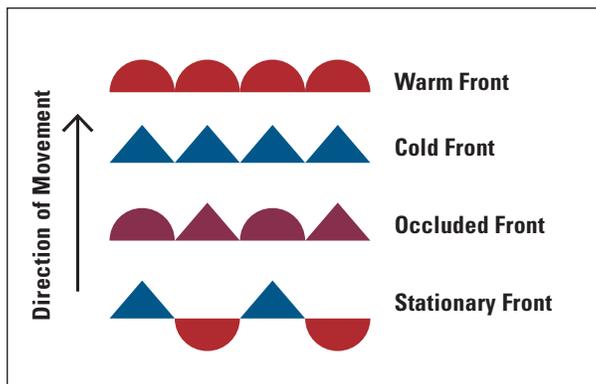


Fig. 2 - The four main types of fronts as depicted on a weather chart.

system consisting of a warm front and cold front that will typically start moving eastward. Weather maps depict stationary fronts with alternating red and blue line segments that have the cold/warm symbols pointed in opposite directions.

Occluded fronts form when air masses of three different temperatures meet up. It's basically a cold front that catches up and passes a warm front, displacing the warm air mass aloft in the process of pushing into the cold air mass ahead. This air mass "sandwich" is a recipe for having the *worst* of both worlds, so to speak, as there's potential for the hazardous features of both cold and warm fronts to be on full display. That means thunderstorms, poor visibility, and shifting winds are all possible. An occluded front is depicted as a purple line with alternating triangles and semi-circles.

Get Up Front with Fronts

So how does one know where frontal activity is or is expected to be? As the saying goes, pictures are worth a thousand words. There's obvious truth in that when it comes to glancing at the many weather charts that provide tons of useful planning data before a flight. A surface analysis chart, for example, provides you with a "big picture" visual of areas of high and low pressure that span the lower 48, along with frontal boundaries, temperatures, dew points, wind directions and speeds, local weather, and visual obstructions (see fig. 3). Using this chart as part of your preflight can help you discover any potential trouble spots you'll want to focus on or discuss further with a weather briefer. Significant weather and surface prognostic charts are two others that can help with painting a good mental picture of weather.

I can recall when I came to fully appreciate the utility of these charts while working towards a lab credit at my university's flight school weather center. Because the Internet was still something of a foreign concept at that time, my duties included retrieving black-and-white weather charts off an old (and noisy!)

dot-matrix printer and posting them along the walls of the lab. To help my fellow flight students with their weather preparation, we would color and highlight frontal boundaries as well as areas of precipitation, strong winds, and freezing levels. In retrospect, the exercise helped expand my ability to "see" and understand weather on a macro scale and helped add to the resources in my flight planning toolbox.

Another source of information for the "big picture" is the Area Forecast Discussions (AFD) provided by each National Weather Service Office across the nation. These text discussions, produced four times daily, cover the critical weather features that will be causing the expected weather over the next seven days. Not to be mistaken for the Area Forecast Synopsis, these discussions can give you the equivalent of a flight briefing synopsis and more.

Forward, March!

So now that we know how different air masses interact and where to find them, let's look at a few strategies you'll want to consider the next time you're in the vicinity of a front.

For starters, if you're flying towards a front, and you notice conditions starting to deteriorate, land and let the front pass before continuing. That will give you a chance to reassess the conditions, recalibrate your plan, and perhaps refuel (both yourself and your aircraft). A passing front will likely also cause a shift in wind direction and velocity. The approach you are already set up to use at your destination may no longer be an option, despite what your initial forecast indicated. Instead you might need to land on a much shorter runway or at an alternate airport if the crosswind component is too much to handle. Keep an eye on your altimeter, too. A pressure change when crossing a front is a given.

And just because you pass through a front does not necessarily mean you're in the clear. Even with a cold front, clouds and rain that are usually confined to within a few miles of its boundaries could, in some cases, extend well behind it. And for that matter, you also don't need a front nearby to experience adverse weather; that can happen anywhere! Upper level troughs and lows can generate adverse weather without having an associated surface front.

Without preparation and a good plan, it's easy to paint yourself into a corner. Instead, have an out, several if possible. Reassess the weather continuously during the flight and use as many inflight sources as you can: onboard radar, ADS-B provided weather, ATC, and of course your own two eyes. Allowing for a greater margin of error, especially at night or in low-visibility situations, can be crucial.

Even though we've outlined some fairly specific expectations with frontal weather, it's important to

remember that no two fronts are the same; always expect the unexpected. Forecasts are generally accurate, but far from exact. About the only sure thing you can count on with any approaching front is that some type of weather change is imminent.

Play your cards right with being prepared for weather and you will stack the odds in your favor for not having any unwanted surprises. I just wish I had better advice for those unexpected in-law drop-ins! 

Tom Hoffmann is the managing editor of FAA Safety Briefing. He is a commercial pilot and holds an A&P certificate.

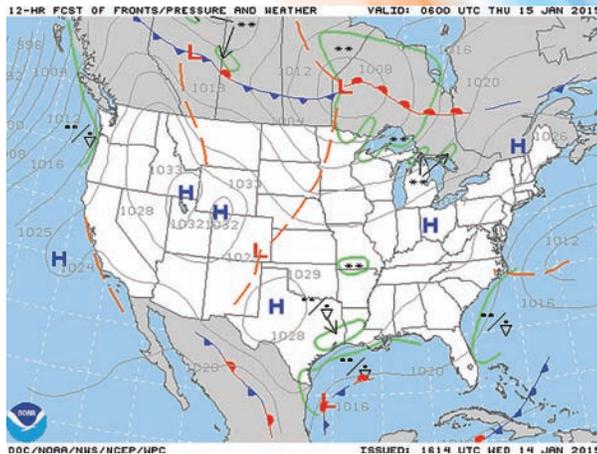
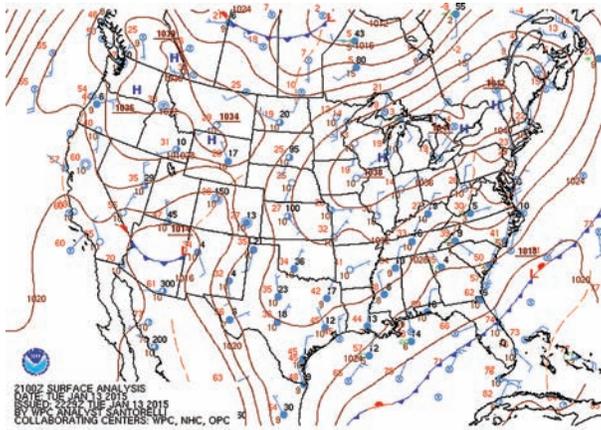


Fig. 3 – A sample surface analysis chart (l) and a 12-hour surface prognostic chart (r).

Subscribe Today!

FAA Safety Briefing is available as an annual subscription from the Government Printing Office. There are three ways to sign up today!

- By Internet at:
<http://go.usa.gov/4FSQ>
- By contacting GPO toll free at:
1-866-512-1800
- Sign up for email updates at:
www.faa.gov/news/safety_briefing/





Getting Crossed-eyed with Crosswinds and Turbulence

The Effects of Turbulent Conditions on GA Pilots

STEVE SPARKS

There's a lot to like about the spring flying season, but gusty winds can be on the rise. Turbulence is one of Mother Nature's most feared (and invisible) forces. While current technology has helped to provide better prediction models, pinpointing turbulence location or intensity is still far from exact.

Since you can't always avoid it — and since Mother Nature doesn't read (much less heed) the weather forecast — your best defense is a good offense. This starts with making sure you're up to

the challenge; so I encourage you to inaugurate your flying year by getting some crosswind flying practice with your favorite flight instructor.

No Easy Breeze

Once you've scrubbed the winter rust off your flying skills, it's a good idea to review some of the best practices and procedures for dealing with winds and turbulence. If you're heading out on a windy day, you can benefit from the common pilot practice

of reporting ride conditions to air traffic control. ATC uses this information to suggest smoother altitudes and/or routes to other pilots operating in the vicinity. This helps to increase comfort and overall safety for all those involved, so make it a point to give as well as receive this information.

When it comes to giving reports, it's a good idea to be familiar with the standard reporting terms and procedures. The Aeronautical Information Manual (AIM) identifies four levels of turbulence: light, moderate, severe, and extreme. Light turbulence is when even loose objects and materials remain at rest inside the cockpit. Moderate turbulence is when unsecured objects inside the aircraft are dislodged and pilots are strained against their seat belts, and severe turbulence is when occupants are jolted violently against their seat belts and aircraft control is momentary lost. Finally, "extreme" turbulence can lead to structural damage to the aircraft and potentially harmful effects to passengers.

The AIM also includes a duration scale indicating whether turbulence is occasional, intermittent, or continuous. When you report turbulence, include your location, altitude, and type of aircraft in order to better predict how these conditions may influence other aircraft in the area.

The "Whew" Factor

Since most crosswind landing accidents do not happen on short final, but rather, occur directly on or over the runway, it's easy to understand why some pilots have anxiety about crosswind landings. The majority of crosswind landing accidents occur within feet of the runway centerline. Fortunately, most crosswind incidents/accidents only result in wingtip strikes, collapsed landing gears, and bruised egos.

Regardless of technique, landing in gusty conditions requires pilots to continue flying their aircraft even after touchdown. Taking a breather is out of the question just because a pilot hears their aircraft's wheels squeak on the runway. Any momentary letdown could result in loss of control. Remember, it could happen in flash so never ever stop flying the aircraft even when confidently on the runway. That means applying appropriate flight control inputs until the aircraft is safely parked on the ramp.

Nervous Pitfalls

When discussing turbulence, there are three different types that can make for a bad flying experience and those are pilot-induced turbulence,

mechanical turbulence, and clear-air turbulence.

Pilot-induced-turbulence (P-I-T) is a strange phenomenon roaming the halls of aviation, and it can influence pilot performance regardless of experience. It is often worse than plain-old turbulence itself. Sound strange? Not to the subconscious pilot reflexes. This condition happens all too frequently in both small and large aircraft. Even airline transport pilots can be affected. In fact, some pilots create more turbulence from sloppy and erratic behavior than that caused by Mother Nature.

Pilots striving for maximum smoothness, professionalism, and passenger comfort should be aware of the "P-I-Tfalls." It is easy to notice and even easier to feel, especially in the seat of the pants. Being herky-jerky with the controls is troubling behavior, but a little self-awareness goes a long ways in smoothing things out.

Mechanical turbulence is another factor pilots need to consider, especially during landings.

Mechanical turbulence is generated by seemingly harmless winds blowing around man-made or natural contours causing airflow to churn from its natural path. These conditions often lead to unpredictable circumstances for unsuspecting pilots. Mechanical turbulence can interfere with a pilot's stabilized approach without warning throwing them off kilter in relationship to the runway centerline. The unintended consequences from hangars and other poorly planned structures near runways can be upsetting. Some pilots are aware of these unique airport circumstances, however, those pilots who are not familiar with the airport should be triggered for a go-around anytime landing conditions become unstabilized.

Clear-air turbulence is one of the strongest forces in Mother Nature's recipe book. It is often generated from rapid atmospheric changes, narrow pressure gradients, erratic jet streams, and thunderstorm development. Clear-air turbulence packs a mean punch leaving pilots feeling dazed and confused. Unfortunately, pilots cannot quickly tap-out of these conditions. Even short durations in moderate turbulence can cause significant fatigue on both pilots and their aircraft.

For unexpected encounters with clear-air turbulence, pilots should try to maintain aircraft attitude.

Pilots striving for maximum smoothness, professionalism, and passenger comfort should be aware of the "P-I-Tfalls" of pilot-induced turbulence.



Photo by James Williams

A pilot struggles to land his airplane in gusty conditions.

Pilots often have to sacrifice deviation on heading and altitude in order to maintain control. From a priority perspective, maintain attitude control, slow the aircraft to minimum controllable airspeed and relay your situation to ATC. Once accomplished, it's time to plan an exit strategy. Changing altitude or directions sometimes will do the trick. In certain cases, pilots might have to make an unplanned stop to wait out these conditions. Regardless, exiting areas of turbulence is always a welcomed relief.

Buckle Up

Since turbulence can lurk at any altitude, pilots and passengers should keep their seatbelts tightly secured and, if installed, shoulder harnesses fastened

ADS-B Check Up

Are you ADS-B equipped? Find out how your equipment is performing. Email 9-AWA-AFS-300-ADSB-AvionicsCheck@faa.gov and include your N-number, ADS-B transmitter, and GPS make/model numbers to find out.



at all times. This is the surest way to prevent injury and defend against unintentionally bumping flight controls or switches in the cockpit. There have been cases where turbulence has knocked pilots unconscious from hitting their heads on cockpit structures.

Landing in gusty crosswind conditions requires skill in a multi-dimensional phase of flight. Pilots have to quickly handle a variety of forces being exerted on the aircraft. Keeping one's cool while maintaining positive aircraft control is the name of the game.

Go Ahead and Go

Executing a timely go-around in response to a botched crosswind landing is smart. Conversely, trying to salvage a landing in these same conditions can land pilots somewhere other than on the runway. Cutting your losses early and getting out of dodge and away from the surface is the surest way to avoid disaster. Staying ahead of the aircraft and not letting external factors control your destiny is shrewd advice. Pilots who are prepared and triggered to fly away from potential danger will greatly reduce workload and stress on themselves and their aircraft.

Prior to landing, pilots should always review what Plan B is going to be should an excessive crosswind or turbulence factor in. It's much easier (and safer!) to execute a well-thought-out contingency plan than to make radical decisions during critical phases of flight.

As the saying goes, takeoffs are optional, but landings are mandatory. This thought particularly resonates when carrying passengers during blustery conditions. Unfortunately, a near perfect condition usually turns out to be just that; "near" perfect. It seems that crosswinds and turbulence are delighted to hang out near runways just waiting to ensnare their next victim without warning. Pilot proficiency is the best way to safeguard you and your passengers from potential harm from these relentless weather conditions.

The next time crosswinds or turbulence pays you an unexpected visit, don't just cross your fingers and hope for the best. Instead, prepare yourself ahead of time by staying proficient with an instructor and/or having a Plan B — even if it means flying away to another airport. The taxi fare will be worth not getting crossed up with crosswinds! 

Steve Sparks is an aviation safety inspector with the General Aviation and Commercial Division specializing in human factors, helicopter operations, and educational outreach initiatives. He is a certificated flight instructor on both airplanes and helicopters.

FLY TO FAILURE

By Sabrina Woods

In aviation maintenance there is a category of parts that are considered “fly-to-fail” components, meaning that the item is replaced once it reaches its visible wear limits or completely fails through normal wear and tear (e.g. light bulbs). While this is a calculated decision in order to economically balance service life, these items are generally not critical to flight. There are many other components that *are* critical to flight. Their lifespans are typically measured in cycles, hours, or time between overhauls. The one thing that every single component on the aircraft is subject to, however, is that under extreme conditions, they *will* fail, regardless of robustness or designed life limit. When this happens, the category “fly to failure” takes on a far more pernicious meaning.

You might be wondering what kind of pressure could buckle a wing spar like a tin can, or snap the lines of a secondary flight controls like twigs. You need not look much further than this edition of *FAA Safety Briefing* to find your answer. In this edition we discuss the dangers of winds, icing, low visibility, and precipitation. While these things can certainly play havoc with your nerves, test the limits of your skill, and affect aircraft performance, what you might not realize is the effect that these things have on your aircraft *itself*.

Hitting the Overload

Your aircraft is designed to withstand a certain amount of forces or loads. The forces are a result of basic lift, weight, thrust, and drag, supplemented by maneuvers and turbulence. The aircraft load limits are typically expressed as a load factor which is the ratio of aircraft lift to its weight. The internal structural response to the loads is commonly referred to as stress, which can be thought of as a kind of “pressure” inside the material. All of these terms are used to measure what the aircraft is being subjected to.

Structural load limit varies from make and model but the gist is the same: exceeding that design limit eats into the strength margin and could have a catastrophic effect. Some of the ways this happens include aggressive maneuvering, exceeding maneuvering speed (V_A), and encountering turbulent forces. And as we all (should) know, there is no force more powerful, awesome, and fiercely unsympathetic than Mother Nature in all her fury. Getting caught up in a storm with extreme winds, rough air, or hail leaves you ripe for just such a situation.

Bending Like Beckham

A metallurgy instructor of mine had his students straighten out a paper clip. After completing our task he asked us to put the paper clip back right again. Couldn't be done. Not even with my best multi-tool. The damage inflicted on the paperclip was permanent. Then the instructor had us bend a piece of the paperclip back and forth until it broke off in our hands. For some it took a few bends — others a little longer — but eventually they all snapped.

Metal fatigue is the weakening of materials that are being subjected to repeat loading and unloading. Tiny microcracks and fissures start to show up in the structure and as they grow



Fatigue induced auxiliary pump crack and popped rivet.

in size, the structure loses strength until it fails altogether. What most people don't realize is that this damage is *cumulative*, meaning that even if you get back down on the ground safely, the cracks remain and grow in subsequent use until that entire component is replaced. Your airplane is designed to withstand a lot of metal fatigue before it gets too weak.

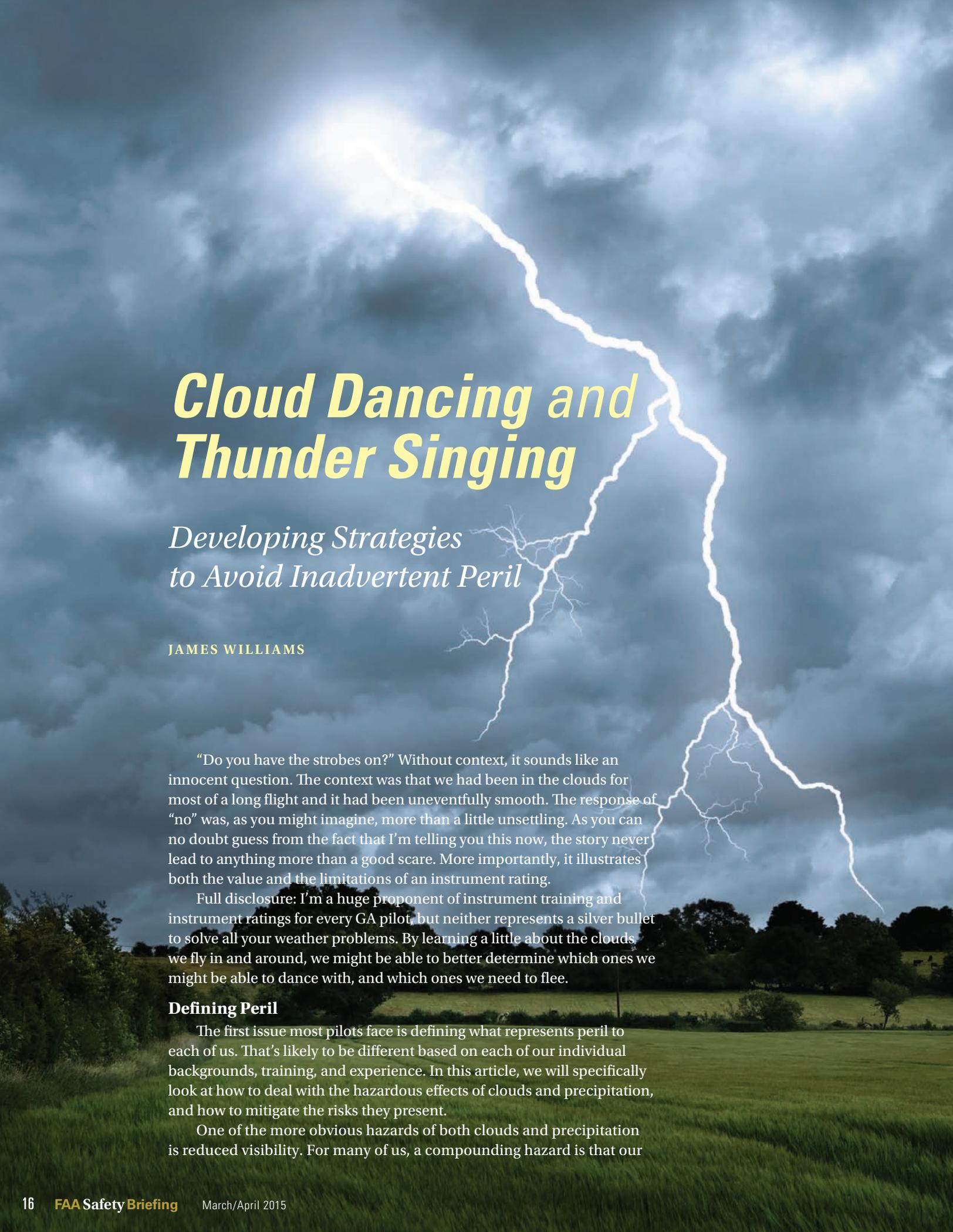
Some in-flight failures can be the result of flying beyond the design capability of the aircraft, but *nothing* produces the environment to start and exacerbate fatigue as quickly as severe weather. Strong gusty winds, crosswinds, and turbulence can exert an overwhelming amount of stress on the aircraft — in particular the wings — causing them to extend beyond the normal flex that comes with routine flight. Although the wings are the most likely victims given their naturally aerodynamic properties, (they *want* to catch the wind) other components such as the propeller, empennage, rudder, and flaps, can be subject to abuse as well. As the aircraft loses strength through fatigue, it is also losing stiffness or resistance to deforming. This is a secondary effect that can lead to other catastrophic failures, such as flutter.

On the Straight and Level

So now that you know how dangerous it is, what can you do?

First, know and understand the design capabilities of your aircraft — pay particular attention to manufacturer limitations — and adhere to them. Next, don't fly into known adverse weather. It can be lethal in far more ways than I have denoted here, so just don't do it! Last, should you have a severe weather encounter, have your plane inspected before your next flight. I can't say it enough — even though you made it through ok, the effect on your aircraft is *cumulative* and on the next flight, the real damage could present itself. Leave “fly to failure” to the light bulbs.

Sabrina Woods is an associate editor for FAA Safety Briefing. She spent 12 years as an aircraft maintenance officer and an aviation mishap investigator in the Air Force.



Cloud Dancing and Thunder Singing

Developing Strategies to Avoid Inadvertent Peril

JAMES WILLIAMS

“Do you have the strobes on?” Without context, it sounds like an innocent question. The context was that we had been in the clouds for most of a long flight and it had been uneventfully smooth. The response of “no” was, as you might imagine, more than a little unsettling. As you can no doubt guess from the fact that I’m telling you this now, the story never lead to anything more than a good scare. More importantly, it illustrates both the value and the limitations of an instrument rating.

Full disclosure: I’m a huge proponent of instrument training and instrument ratings for every GA pilot, but neither represents a silver bullet to solve all your weather problems. By learning a little about the clouds we fly in and around, we might be able to better determine which ones we might be able to dance with, and which ones we need to flee.

Defining Peril

The first issue most pilots face is defining what represents peril to each of us. That’s likely to be different based on each of our individual backgrounds, training, and experience. In this article, we will specifically look at how to deal with the hazardous effects of clouds and precipitation, and how to mitigate the risks they present.

One of the more obvious hazards of both clouds and precipitation is reduced visibility. For many of us, a compounding hazard is that our

aircraft lack weather detection technology beyond what a friend once euphemistically described to me as the Mark One Eyeball Observation System. As soon as the literal blinding effect from the weather sets in, our distant weather detection range drops to a few dozen feet. The march of technology has helped in this department, with the advent of more affordable and accessible cockpit weather data, but it will likely take a good many years to get to the point of ubiquity. This point, by the way, assumes that you are in a position to fly into the clouds. If you're not properly trained, rated, and proficient, any dip into weather less than VFR minimums is best avoided.

The next hazard we face is what may lurk in the clouds: updrafts, downdrafts, and turbulence. The type of cloud encountered will provide clues as to the level of hazard that might lurk within. In the following sections we'll look at the particulars of each cloud type and what we should consider in our weather strategies.

Be Clear on Clouds

There are three established basic forms of clouds: cirrus, cumulus, and stratus. While there is some overlap in their genesis and characteristics, each cloud type presents a different set of possible hazards. First, and most easily dealt with, are cirrus clouds. Cirrus clouds are high altitude denizens made of ice crystals that usually form above 20,000 feet above ground level (AGL). They are generally not considered a threat in terms of turbulence or icing as they form in stable air. In terms of hazards, assuming we can even get up there, cirrus clouds are very low risk. And since they only form in IFR airspace, we don't need to be overly concerned with visibility impacts.

Next we consider cumulus clouds, aka the "happy" clouds. These clouds are the puffy white type that are formed of liquid water droplets near the surface and can vary in height and size depending on atmospheric instability. They are detached from each other and do not produce rain. As their formation mechanism suggests, these seemingly "happy" clouds can be turbulent, with hazard levels ranging from minor to significant. As far as visibility is concerned, they are much more view-limiting than their cirrus cousins. On the plus side, the detached nature of cumulus clouds means that visibility limitations should be brief as you pass through them and that they are easily navigated around should you not want to fly through them. Also, don't let their "happy" appearance fool you; They may include supercooled water droplets which could increase the risk of icing.

Variants of cumulus clouds include altocumulus and cirrocumulus, which form at medium and high



Photo courtesy of Avidyne

Onboard weather radar can help in making tactical decisions in flight.

altitudes, and cumulonimbus, which are characterized by significant vertical development and pose the greatest hazards to pilots. The addition of the -nimbus suffix to any cloud type indicates that the cloud is rain bearing. But with cumulonimbus clouds, it's more than just the rain that concerns us. A cumulonimbus cloud may produce a thunderstorm. These are typically very large clouds in most cases exceeding 20,000 feet AGL, and in extreme cases approaching 60,000 feet AGL. That means there's really no flying above them in most GA aircraft. You should also plan to avoid them by a wide margin; the FAA recommends 20 nautical miles. This is because large cumulonimbus clouds can throw hail miles outside their physical dimensions. Between the threats of hail, lightning, and devastating turbulence, flying through a cumulonimbus cloud in a GA aircraft ranks up there with swimming with great white sharks in a wetsuit made of freshly cut seal meat in my book. (This is to say extremely hazardous.) This turbulence makes any concerns about visibility and icing, which do exist, second order priorities.

Next up: stratus clouds. Stratus clouds have an expansive sheet-like structure. As the name suggests, they spread as layers across broad areas and are generally limited in vertical development. Moderate icing risks and even some turbulence concerns are possible in the medium altitude altostratus clouds. Stratus clouds are sometimes referred to as "good IFR" clouds. This is because they tend to be smooth and widespread which makes them a good dance partner if you're so inclined (and rated). The group also contains the rain clouds nimbostratus. Unlike their cumulus cousins, they don't bring threats of hail and lightning.

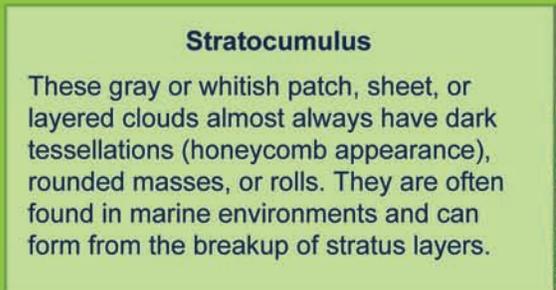
(continued on page 20)

Cloud Spotting



Cumulus

These puffy clouds are formed of liquid water droplets near the ground and can be turbulent. Over land, they develop on clear days due to daytime convection. They typically appear in the morning, grow, and then dissipate in the evening.



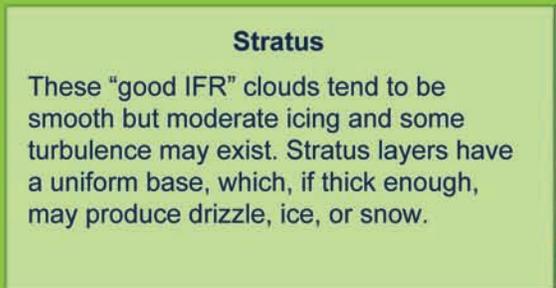
Stratocumulus

These gray or whitish patch, sheet, or layered clouds almost always have dark tessellations (honeycomb appearance), rounded masses, or rolls. They are often found in marine environments and can form from the breakup of stratus layers.



Cumulonimbus

These towering giants can produce tornados, thunderstorms, lightning, hail, icing conditions, and devastating turbulence. The FAA recommends keeping a distance of 20 nautical miles from these clouds.



Stratus

These "good IFR" clouds tend to be smooth but moderate icing and some turbulence may exist. Stratus layers have a uniform base, which, if thick enough, may produce drizzle, ice, or snow.

Signposts of the Sky

Cirrus (Cs)



Cirrocumulus (Cc)

Cirrus (As)



Stratocumulus (Sc)



High Clouds

Middle Clouds

Low Clouds

10,000 ft. – 60,000 ft. AGL

6,500 ft. – 13,000 ft. AGL

Surface – 6,500 ft. AGL

Paul Cianciolo

Cirrus

These wispy filament-like clouds form mostly white patches or narrow bands in high-altitude stable air. They are composed of ice crystals and their transparent character depends upon the degree of separation of the crystals.



Cirrocumulus

These thin, layered clouds without shading are composed of very small elements in the form of regularly arranged grains or ripples. Generally, they represent a degraded state of cirrus and cirrostratus clouds and are uncommon.



Cirrostratus

These transparent, whitish veil clouds with a fibrous (hair-like) or smooth appearance usually cover the whole sky. During the day, they are thin enough to still see shadows on the ground and can produce a halo around the sun or moon.



Altostratus

These white/gray patch or layered clouds have a roll-like appearance and can cause some turbulence and small amounts of icing. This common middle cloud often appears at different levels at the same time and with other cloud types.



Altostratus

These gray/bluish layers totally or partially cover the sky, with the sun being dimly visible. They are frequently associated with approaching frontal systems and contain little or no turbulence and moderate amounts of icing.



Nimbostratus

These clouds result from thickening altostratus layers, are dark gray, and diffused by falling rain or snow. The cloud base lowers as precipitation continues. Low, ragged clouds frequently occur beneath, which may merge with its base.



Finally, we come to stratocumulus clouds, which as the name suggests, are a combination of stratus and cumulus. Stratocumulus clouds generally combine the widespread nature of stratus clouds with the vertical development of cumulus clouds. One aspect that makes stratus and stratocumulus clouds a concern is the fact that they can hide from view things like embedded thunderstorms, as I learned firsthand.

Assets and Liabilities

With our perils now defined, let's do some self-analysis. First, take stock of your strengths and limitations. This will be different for every pilot (and should be an ongoing process as well). Having an instrument rating is nice, but how prepared are you to use it? There's a huge difference between being able to handle popping in and out of a few little cumulus clouds and slogging along all day in a stratus deck.

Are you sharp on instruments, or a little rusty? Are you ready for a few bumps, or do you prefer a smooth ride? Is your aircraft properly equipped, or should you be looking to upgrade? These are just a few of the questions you should ask yourself. Once you have a thorough list of what you're proficient with, what you're not, and what you'd rather not do, we can look at ways to mitigate those risks and help develop some good personal minimums.

Strategic vs. Tactical

Now that we know some of the risk factors and what we have to offer (both our skills and limitations), we have to decide what level of mitigation we want to employ. Some situations lend themselves to the tactical level of response, meaning something that we can do on the fly without extensive planning. These kinds of responses include simply deviating around small cumulus clouds to maintain VFR, requesting a different altitude from ATC during an IFR flight to get out of a stratus layer, or canceling a flight in the vicinity of a thunderstorm. Other situations require more strategic coordination. Examples of strategic responses would be adding equipment to your aircraft to better handle weather hazards, receiving instrument training, or planning your trip with weather contingencies.

Of course, if you're not instrument rated, avoiding the clouds is the best policy. But how would you mitigate the risk of accidental IFR? Focused training would be a good place to start. Work with a properly rated instructor to practice escape maneuvers like a 180 degree turn or a controlled descent. You can also work on decision making with the instructor by having them quiz you when you feel like you need to turn to avoid a cloud. This can help you develop a sight picture in your mind of what a turnaround point might look like. It's also helpful to have real experience in the clouds should you find yourself there accidentally. Again, these exercises should only be done with a qualified instructor as a safety measure. While an instrument rating would be a better solution, at least some ongoing training, maybe once or twice a year as conditions and availability allow, can give you a basis to work from.

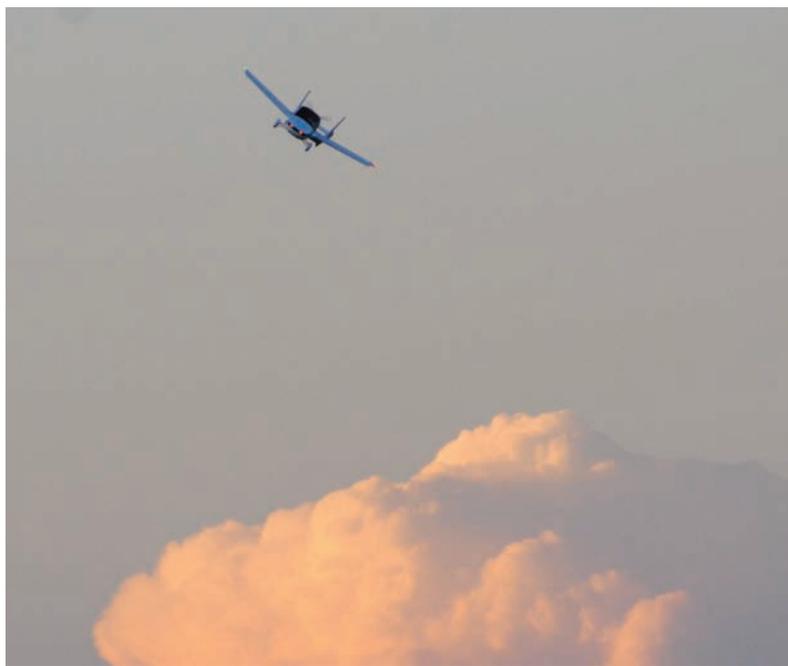


Photo by Tom Hoffmann

By learning about the clouds we fly in and around, we can better determine which ones we might be able to dance with, and which ones we need to flee.

The idea is to develop a “play book” of responses that can be used in conjunction with your personal minimums. Then, when you have to make a decision, you have both a predefined decision point and a predetermined plan of action. By combining this strategy with a greater understanding how clouds work and how they differ, we can work toward a happy medium of properly mitigated risk. ✈️

James Williams is FAA Safety Briefing's assistant editor and photo editor. He is also a pilot and ground instructor.

For More Information

Dos and Don'ts of Data Link Weather- July August 2010 p. 20
www.faa.gov/news/safety_briefing/2010/media/julaug2010.pdf

Cruise Control: Avoiding VFR into IMC- March April 2011 p. 16
www.faa.gov/news/safety_briefing/2011/media/MarApr2011.pdf

The Terrible Ts: Turbulence, Thunderstorms, and Tornadoes- May June 2012 p.12
www.faa.gov/news/safety_briefing/2012/media/MayJun2012.pdf

Pilot's Handbook of Aeronautical Knowledge- Chapter 11
<http://go.usa.gov/SBFT>

Don't Let Ice Drag You Down

By James Williams

One of the key risk factors for flying in the clouds is icing. I didn't get too deep into the topic in the main article because it's a discussion that requires more space than we have here and it's one we've covered recently (see the FIKI Wiki article on page 21 of the November / December 2014 *FAA Safety Briefing* at: www.faa.gov/news/safety_briefing/2014/media/NovDec2014.pdf). But here is a brief recap of some of the more pertinent points of dealing with or avoiding ice.

What's Your Strategy?

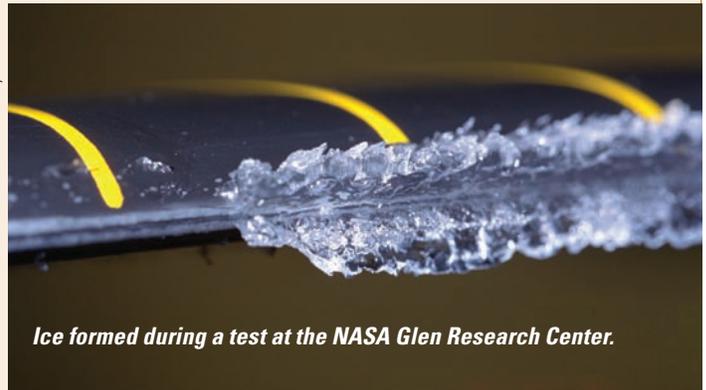
The first thing we need to know is what options are available. Does the airplane have any deice or anti-ice capability? If so, to what level is it certificated? As I discussed in the FIKI Wiki article, there are differing levels of deice/anti-ice protection, and knowing the distinction is critical. Some systems are only designed to aid in your escape from icing, while others allow for you to fly into light to moderate icing for a period of time. Of course, any system — even the sophisticated ones used by airliners — can be overcome by heavy icing conditions, so vigilance is a must. This knowledge helps us frame what strategies are available.

If your aircraft has no ice protection beyond pitot heat, then avoidance and *immediate* escape are the only options on the table. Flirting with clouds during the winter should be done only with caution and a close eye on the freezing levels.

If your aircraft has a basic non-FIKI certified system, it's a good idea to know what exactly is and isn't covered since some non-FIKI systems are more robust than others. But regardless of the coverage, your aircraft is still not certificated for flight into known icing conditions — which means that a rather expeditious exit from those conditions is required. What the system does for you, though, is give you a safety margin to work with should you encounter icing.

If your aircraft is FIKI certified, then you have the widest range of options. That doesn't mean you are invol-

Photo courtesy of NASA



Ice formed during a test at the NASA Glen Research Center.

nerable to icing. Every ice protection technology has its strengths and its limitations, but your equipment does give you the option of flying through some icing without serious consequences.

Knowledge is Power

The best way, for everyone, to not get dragged down by ice is to not get into it in the first place. It's a strategy that works regardless of equipment. But even if you've got a hardier aircraft than most, knowing where you want to fly (and don't want to) is a good idea. The place to find the best information on that is the National Weather Service's (NWS) Aviation Digital Data Service (ADDs). ADDs Icing products are available at: www.aviationweather.gov/adds/icing

Two of the most powerful tools for any pilot are the Current Icing Product (CIP) and Forecast Icing Product (FIP). These tools allow a pilot to determine at a glance the likelihood and severity of icing in a certain area as well as the possibility of encountering super-cooled liquid droplets (SLD). This is very important as SLD can cause extreme icing conditions that every aircraft should avoid, even those with FIKI. You can also check these conditions at varying altitudes which will aid you in flight planning.

Between the right knowledge and a sound strategy, we can give icing the slip and fly as much as possible year round.

James Williams is FAA Safety Briefing's assistant editor and photo editor. He is also a pilot and ground instructor.

But Does It Count?

Generally speaking, pilots are anxious to know and do the right thing, especially when it comes to safety and to rules that we're supposed to follow.

In that spirit, I recently got a question on how GA pilots can be sure they are getting a "legal" or "approved" weather briefing. This topic is of particular interest in an era where the number of sources, formats, and delivery methods is large and growing all the time.

"Required" vs "Encouraged"

Let's start with the bottom line. As explained in Chapter 7 of the *Aeronautical Information Manual* (7-1-3), air carriers and operators certificated under the provisions of 14 CFR part 119 are required to use the aeronautical weather information systems defined in the Operations Specifications issued to that certificate holder by the FAA. Part of this approval includes FAA acceptance or approval of the procedures for collecting, producing, and disseminating aeronautical weather information, as well as the crew member and dispatcher training to support the use of system weather products.

The AIM goes on to state that operators not certificated under the 14 CFR part 119 are "encouraged" to use FAA/NWS products through Flight Service Stations, Direct User Access Terminal System (DUATS), and/or Flight Information Services-Broadcast (FIS-B).

In a nutshell, then:

- There is no regulatory requirement for part 91 GA operators to use any particular weather source.
- There are no "required" or "approved" weather sources for part 91 operations.
- There is no prohibition on using other sources either as a substitute for, or a supplement to, AFSS or DUAT/DUATS briefings that the AIM encourages GA pilots to use.

What's the Big Deal?

So why the emphasis on these particular weather sources? As noted in the AIM (also in 7-1-3(f)):

(W)eather services provided by entities other than FAA, National Weather Service (NWS), or their contractors (such as the DUAT/DUATS and Lockheed Martin Flight Services) may not meet FAA/NWS quality control standards.

Hence, operators and pilots contemplating using such services should request and/or review an appropriate description of services and provider disclosure. This should include, but is not limited to, the type of weather product (e.g., current weather or forecast weather), the currency of the product (i.e., product issue and valid times), and the relevance of the product.

The point of encouraging GA pilots to use DUAT/DUATS or AFSS is to provide several benefits. The first is a known, comprehensive, and standardized weather briefing product. The FAA specifies the elements that must be included for standard, abbreviated, and outlook briefings. DUAT/DUATS or AFSS briefings include all these elements, which are provided in a logical and predictable sequence.

Second, AFSS briefers are certified as pilot weather briefers, which means that they have been trained to translate and interpret National Weather Service products. The briefer can thus explain things that may not be immediately apparent to the pilot, and respond to questions about specific altitudes, routes, and locations.

The third benefit is that there is a record that the pilot received a specific type of weather briefing at a specific date and time. Does it matter? GA pilots are not required to use "approved" weather. Neither I nor my colleagues are aware of enforcement actions for a "bad" weather source. If there is an accident or incident, however, a documented official weather briefing would help show that the pilot complied with the 14 CFR 91.103 requirement to obtain "all available information" about the proposed flight.

Other Governmental Sources

Along with the National Center for Atmospheric Research (NCAR), governmental agencies such as the NWS and its Aviation Weather Center – which includes Aviation Digital Data Service (ADDS) – display a wide range of weather information that can supplement data obtained through a standard briefing. As the AIM notes, however, some of this information may be derived from model data or experimental products. So be cautious and, as always when planning flights in a light GA aircraft, take a conservative approach to its use.

HOT, HIGH, AND HEAVY

Beware the Deadly Density Altitude Cocktail

PAUL CIANCIOLO



Locations that are hot, high, or a combination of both require a careful performance calculation.

It's not possible to talk about weather without mentioning the negative effects that density altitude can have on your aircraft. If you're not careful, this invisible phenomenon, which can only be *experienced* through the performance of the aircraft, can sneak up and rob you of lift, thrust, and power. The only other option you are left with is "down."

Hindsight is 20/20

Before getting too detailed about what density altitude is, let's take a look at how its performance-robbing effects took a serious toll on a Stinson 108 during takeoff in the following National Transportation Safety Board (NTSB) accident report. A YouTube video filmed from inside the cockpit provides a more chilling perspective of the event; it's available at <http://youtu.be/OVM3RRd1vf0>.

Here is the official NTSB accident report synopsis:

Before taking off from the 5,000-foot turf-dirt airstrip located at an altitude of 6,370 feet mean sea level, the pilot checked his performance charts and calculated that the density altitude was about 9,200 feet; this was 3,200 feet above the 6,000-foot maximum altitude listed in the takeoff performance charts. He also noted that at the time of departure, the wind was from 30 degrees at 10 knots, with gusts to 20 knots, which was close to a nearly direct tailwind for the takeoff from runway 23. The pilot indicated that the airplane was within 86 pounds of its maximum gross takeoff weight.

When the airplane was about three-quarters of the way down the runway during the takeoff roll and not yet airborne, the pilot was about to abort the takeoff, but a gust of wind lifted the airplane in the air. The pilot thought the airplane would remain airborne, but when he could not get the airplane to climb as expected, he attempted to locate an open field to land in.

However, the airplane subsequently encountered a downdraft, collided with a stand of trees, and came to rest inverted about 1.64 nautical miles from the departure end of the runway. A post-accident examination of the airplane and engine revealed no mechanical malfunctions or failures that would have precluded normal operation.

Luckily, all four onboard survived the accident. Even though the pilot had nearly 5,000 hours of flight time, the effects of density altitude caught him by surprise. The NTSB determined that the probable cause of the accident was “the pilot’s inadequate preflight planning and decision to takeoff at a density altitude outside of the airplane’s takeoff performance envelope, with a tailwind, and near the airplane’s maximum gross weight, which resulted in the airplane’s inability to climb and clear trees.”

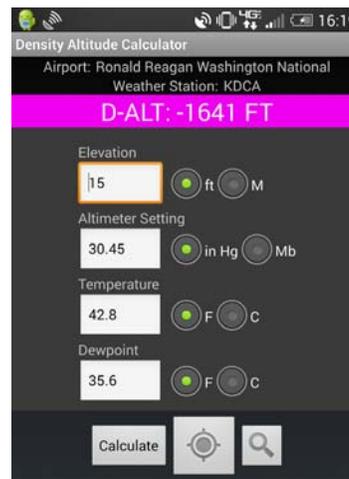
Editor’s Note to the pilot — thank you for keeping this video on YouTube so other pilots may learn from this accident.

Thin Air

By definition, density altitude is pressure altitude corrected for nonstandard temperature. In other words, an increase in temperature at a particular atmospheric pressure causes the density of air at that pressure to appear as though it resides at a higher physical altitude.

When density altitude is high, the air is less dense. As a result, an aircraft will perform as if it is flying at a higher altitude, which results in degraded climb performance and acceleration. Lift is reduced because the thin air exerts less force on the airfoils. Thrust is slower because a propeller is less efficient in thin air. Power output is also reduced, because the engine is taking in less air. Instead of measuring density altitude in height, think of it as a measure of aircraft performance.

In the accident report we reviewed, the runway was considered to be at an elevation of 9,200 feet according to the density altitude calculation, which is above the aircraft maximum altitude on the performance chart. The airplane was also pretty close to its maximum takeoff weight. It physically could not perform under those conditions. The only way to



This is an example of an app used to calculate density altitude. It’s as simple as opening the app and reading the calculated altitude. The negative altitude shown here is due to the location of FAA headquarters near sea level and during the winter.

know this fact is to calculate the density altitude and luckily, there is now an app for that.

Getting There

The effects of density altitude can be insidious. You can mitigate these risks in many ways:

1. Avoid takeoffs and landings when midday temperatures are scorching hot. Take advantage of cooler mornings and evenings when the effects of density altitude are less.
2. A lighter load means more flexibility when trying to take off at a high-elevation airfield on a hot and humid day. To maximize this benefit, be prudent when considering fuel and non-essential passengers, and be extra vigilant of how much everyone and everything weighs.
3. If flying in a high-density altitude situation, you may need to adjust the mixture control on takeoff to maximize engine power. Consult your POH for the best mixture setting given the conditions at your takeoff airport.
4. Know before you go, and plan for performance. The reduction of lift and power may require a longer takeoff roll than normal, which may result in being tempted to prematurely rotate — possibly resulting in a stall. Even low-altitude airports can be negatively affected by density altitude under the right conditions.

The right combination of warm and humid air can drastically impair your aircraft’s performance and push it beyond its limits. Don’t wait until it is too late to realize that your aircraft cannot perform. Make density altitude a check in your preflight planning process. 

Paul Cianciolo is an assistant editor and the social media lead for FAA Safety Briefing. He is a U.S. Air Force veteran, and a rated aircrew member and search and rescue team leader with the Civil Air Patrol.



Kick The Tires ...

Aviation tires just don't get enough credit even though they are literally the last thing to depart the Earth upon takeoff, and the first thing to contact terra firma upon landing. The overwhelming amount of stress they endure in these two, relatively short phases of flight is staggering. But still, they aren't as snazzy as an aircraft engine, or as exciting as a new avionics device. So at times these components play second fiddle to everything else a pilot must scrutinize on the aircraft — even though tire checks are easily just as important to a good preflight.

This important task should incorporate more than a perfunctory kick and a casual glance to see if the rubber is flat. In particular, the changing weather can (and should) influence how you go about attending to business, so for the next 600 words or so, we are going to spend some time highlighting the finer points of good tire maintenance.

The Basics

A good tire inspection includes close examination of the rubber. Things to look for include cuts, worn spots, frays, bulges or “bubbles,” sidewall damage, and foreign objects embedded in the tread. You can greatly reduce foreign object damage by eliminating those bits and pieces from hangar floors and/or runways and, for the sake of the environment (and your wallet), replace tires only when they are fully worn rather than just when convenient.

Cuts and foreign objects embedded in your tread obviously weaken the integrity of the tire. Bulges or bubbles can also be an indication that there is a defect, one that can cause catastrophic failure of a tire at a moment's notice. These failures can cause further damage to the aircraft, and significant bodily harm, or worse if caught in the line of fire. Handle this situation with extreme caution.

Cords, strings, and fabric are just a few of the items the manufacturer has provided in order to indicate wear on a tire. It is best to check your maintenance manual for applicability and specific procedures, but it is likely that if these things are visible, it might be time for a change. This is all in addition to ensuring your tires are properly inflated to the correct PSI. By industry standards, this is the single most important parameter of a tire's maintenance and safety. Air is insidious. It will take any and every opportunity to escape when it can. Using pure nitrogen to fill your tires, as opposed to “normal”

air which is only about 78 percent nitrogen (and 21 percent oxygen), can slow this effect, but it will still deflate over time. Therefore, pressure checks should be made every time you fly.

Goldilocks Treatment

Take the “Goldilocks” approach to taking tire pressure — not too hot, not too cold, not too much, not too little, but juuuust right. In other words, for basic inflation procedures, check before the first flight when your tires are cool. Never reduce the pressure of a hot tire. Unless you are a bush pilot, underinflating is just a bad idea. It makes for “mushy” handling and causes undue and excessive wear on the “flattened” tire as it fights to uphold the weight and demands of the aircraft while taxiing. Overinflating is just as much of a hazard. It can make for poor handling, extra “bounce,” and, if taken to extremes, you run the risk of seeing the tire fail (explode) during the actual act of inflation.

Last, a loaded tire will average four percent higher PSI than an unloaded tire, so take this into consideration when you are performing checks or replacing a tire. Always allow about 12 hours for full stretch to take effect after a new mounting. Maintain equal pressure for dual-tire wheels, and above all, make sure you calibrate your inflation gauge regularly.

Weather Matters

Gas expands when heated and contracts when the temperature decreases, so you have to account for the weather when you are doing your checks. When the temps drop, air gets thicker. For tires this means that for every 5° F temperature change, the pressure in the tire will also change about one percent, so lower temps will result in lower tire pressures. This works the same way for warmer climates. Direct sunlight has an effect on the rubber in your tires (faster wear) and hot weather may also make your tires overinflate. Again, using pure nitrogen might help to mitigate some of these variations, but in extreme weather, the best line of defense is knowing your tire's tendencies and making adjustments for the changes.

Admittedly, there is little spice and pizzazz to the aircraft tire, but these little hardworking bastions are what solidly anchor your aircraft to the ground and steadily move you through those key non-flight moments. Give them the time, respect, and effort they deserve on your next preflight.



Photo by Julian Greenway

I'VE GOT WEATHER! *(... Now What Do I Do with It?)*

SUSAN PARSON

I'm carbon-dating myself again. When I was first learning to fly, there were no dinosaurs left, but there *were* still Flight Service Stations physically located at certain airports around the country. My home airport hosted an FSS (as opposed to today's Automated Flight Service Stations — AFSS), so one of my earliest lessons involved marching into the quietly humming facility to get an official weather briefing for my flight. I had completed ground school, so I knew to ask for a standard briefing. I knew the information was provided in a certain predictable sequence. I could listen and understand the general location/sig-

nificance of air masses and frontal systems. I carefully noted the METAR and TAF data for the local flying area. And, for good measure, I always requested a printed copy — cheerfully delivered in an accordion-folded stack of paper from a dot-matrix printer — you know, the kind of paper with tear-off punch-hole strips on either side. So yeah, I could proudly tell my instructor that “I've got weather!”

Since private pilot training took place only in visual meteorological conditions (VMC), the fact that my “understanding” of that painstakingly acquired weather briefing data was, oh, maybe an

eighth-of-an-inch deep, was not terribly obvious to me. Because most of my subsequent training for the instrument rating also occurred in VMC, I was still painfully unaware of how little I really understood.

Do You “Get” What You’ve Got?

The gaps in my weather knowledge and understanding became crystal clear on a very cloudy day a few months later. Freshly rated as an IFR pilot, I was returning to my home airport from a family visit to North Carolina. Because I didn’t really “get” the weather I got in my briefing, I inadvertently launched into rapidly deteriorating conditions — no kidding, widespread instrument meteorological conditions (IMC) that eventually forced a diversion, a holding pattern, and an instrument approach to near minimums. Thanks to solid training, my single-pilot, single-engine encounter with unexpected low IFR (LIFR) resulted in a safe landing and, as we like to say, the outcome was never seriously in doubt. Still, I’m not proud of the “go” decision I made that day. It was dumb, and it arose from inexcusable ignorance.

The experience does have a silver lining because it provided powerful motivation to become a dedicated and lifelong student of aviation weather. Eventually, it also led to discovering a simple, but very effective, framework for deciding whither and whether to fly in whatever type of weather presents itself.

Know Your Enemy ...

One of the first things I did after my eye-opening experience was read to deepen my understanding of basic meteorology. Two books stand out. Even if you do no more than read the first few chapters, you will never regret time invested in Richard Collins’ *Flying the Weather Map*. Collins’ explanation of air masses and weather (frontal) systems did wonders to clear my previously hazy understanding of these critical concepts.

The second “go to” weather book in my aviation library is Ralph Buck’s *Weather Flying*. The key takeaway from Buck’s book is his deft summary of the three ways that weather can affect an aviator:

1. Weather can create wind or turbulence.
2. Weather can reduce ceiling and visibility.
3. Weather can affect aircraft performance through conditions such as high density altitude or icing.

With the help of these two accomplished pilot-authors, I began to actually understand the weather forecasts I saw on television and, more importantly, to understand the information provided in aviation weather briefing products. Thanks to Ralph Buck’s framework, I also began to notice that data in aviation meteorological reports (METAR) and terminal

aerodrome forecasts (TAF) is structured to provide information on each of the three ways that weather affects those who fly. I finally had not only the tools needed to mine the most critical pieces of information from the printout, but also the foundation for evaluating a specific day’s weather in terms of both the individual pilot (me) and the specific airplane I planned to fly.

... And Know Your Friends

The mention of “specific airplane” brings up another important part of the weather flying puzzle. Just as pilots differ widely in their levels of knowledge, training, experience, and piloting ability, it’s a fact of life that some airplanes are more capable than others. So you need to think of the plane you’re flying as your partner — your teammate in this activity. The weather analysis for every flight should thus consider the collective capabilities of the pilot and the airplane. I’ll discuss that process in detail shortly, but first let me stress a couple of very critical points:

- No matter how skilled a pilot you are, you can’t adequately compensate for what your airplane partner lacks in terms of performance capability. You may be Super Pilot, but there are limits to what kind of weather you can consider when you are flying, say, a *Super Cub*.
- Your technologically advanced airplane can be very helpful, but no airplane can adequately compensate for deficiencies in its pilot’s knowledge, training, experience, or skill.

Getting the Picture

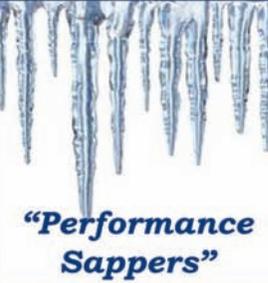
Now let’s look at a structured approach to making sure you’ve really “got” weather.

Wind

The first item in both METARs and TAFs provides information on an airport’s wind direction and velocity. A key to wise weather decision making is to consider these numbers in relation to both the pilot and the plane.

With respect to the *pilot*, the primary issue is proficiency and comfort with a known or forecast crosswind. If you are not comfortable with the crosswind component at the departure airport, it’s a good day to stay on the ground or, better yet, hire a qualified instructor to help scrub the rust off your crosswind takeoff, approach, and landing skills. If it’s the crosswind at the destination airport that gives you pause, the next step in the windy weather decision-making process is to determine whether the winds are more favorable at alternate airports within range. When crosswind comfort is an issue at either end of the flight, it also pays to check wind at airports along your route in the event that diversion becomes necessary.

Weather Decision-Making and Personal Minimums

<p>GOAL: Analyze capabilities of the pilot/plane “team” in terms of expected weather conditions.</p>	 <p style="text-align: center;">Wind & Turbulence</p>	 <p style="text-align: center;">Ceiling & Visibility</p>	 <p style="text-align: center;">“Performance Sappers”</p>
 <p style="text-align: right;">Pilot</p>	<p>How much crosswind can I safely handle?</p> <p>What is the strongest crosswind I’ve experienced?</p> <p>How recent is my crosswind experience?</p>	<p>Instrument rated? Legally current? Proficient?</p> <p>What are the lowest conditions I’ve comfortably handled?</p> <p>What pressures do I face?</p>	<p>Have I calculated the required performance for these conditions?</p> <p>Am I proficient in the techniques and procedures needed to get the required level of performance from the airplane?</p>
 <p style="text-align: center;">Plane</p>	<p>What is the maximum demonstrated crosswind component for this aircraft?</p> <p>For turbulence, what is the design maneuvering speed (V_A), and what power setting will achieve it?</p>	<p>Is the aircraft legally equipped for IFR flight?</p> <p>Do all required instruments work properly?</p> <p>Is there any unfamiliar equipment?</p>	<p>Do the performance calculations show that the aircraft can perform as needed for these conditions?</p> <p>Can it still perform when I add a safety margin?</p>

For the *airplane*, the primary issue is its maximum demonstrated crosswind component, which is usually in the range of 12-17 knots for light GA aircraft. Though it is not a legal limitation, a GA pilot is wise to regard this value as a personal limitation. Here’s why; aircraft manufacturers develop aircraft performance data through rigorous flight tests. These activities are conducted by professional test pilots who are, as the phrase goes, “simulating average pilot skills.” However hard we try, non-commercial GA pilots still may not obtain the aircraft performance that a professional simulating an average pilot’s skill level can achieve.

Also, even if the true maximum crosswind component is higher than the published (demonstrated) value, there is inevitably a point at which full deflection of a given airplane’s rudder, in combination with aileron input, will not be sufficient to correct for the drift resulting from a stiff crosswind. Pilots refer to this condition as “running out of rudder.” I speak from experience when I report that it does get your attention. For me, that particular teachable moment came on a gusty autumn day when I was first learning to fly from the right seat of a Cessna 150. Even with the right rudder pedal jammed all the way to the floorboard,

the trusty little trainer was no match for the crosswind at that particular airport. Bottom line: regardless of pilot proficiency in crosswind flying, it is also critical to consider whether the airplane is up to the challenge. A crosswind that is perfectly manageable in the beefy twin-engine Piper *Aztec* may well be too much for a tiny two-seat trainer.

Ceiling & Visibility

The second component of METARs and TAFs covers ceiling and visibility, conditions that are the primary reason for learning to fly by reference to instruments. For legal instrument flying, an aircraft must be properly equipped and certified for IFR. Regardless of equipment, the airplane itself is not affected by the presence of clouds and precipitation. Therefore, weather decision-making in this area most logically focuses on the pilot.

For legal operation in IMC, a pilot must be both instrument rated and instrument current in accordance with Title 14 CFR sections 61.3(e) and 61.57, respectively. For safe operation in IMC, though, the pilot must also be proficient in basic attitude flying, instrument operating rules and procedures, course intercepts and tracking, holding, approaches, and all

other aspects of instrument flying. The existence of the IFR currency requirement bespeaks the perishable nature of instrument flying skills. As many pilots have discovered, maintaining just the legal minimum requirement for currency may not be enough for proficiency and confidence. If you haven't flown in IMC recently, or if you have any doubts about your proficiency level, it behooves you to get some practice with a safety pilot or dual IFR-refresher training with a qualified instrument instructor.

Performance

The third major way that weather affects aviators is through its impact on aircraft performance. An airplane is a machine, and all machines have performance limits. Consequently, a vital part of deciding whether to fly in weather likely to include such performance-reducing elements as icing or high-density altitude is to have a rock-solid understanding of what your airplane can — and cannot — do. As noted earlier, the best piloting skills in the world cannot overcome the airplane's physical performance limitations.

The temperatures in METARs, TAFs, and winds and temperatures-aloft reports can give you a good indication of prospects for icing and high density altitude. Unless your airplane is properly equipped for flight into known icing conditions (FIKI), you shouldn't need to think very hard about whether to launch in any kind of freezing precipitation. Remember, too, that even FIKI-equipped aircraft have limits. 'Nuff said.

Regarding other performance issues such as conditions involving high density altitude, please take your performance calculations with a big grain of salt and an even bigger added safety margin. If the ground school memory of doing triple interpolations to calculate a two-foot difference in takeoff distance has soured you on the utility of performance charts, rest assured there is an easier way. Simply use the next highest numbers shown on the chart to get a conservative "ballpark" estimate, and then add a 50-100 percent safety margin. For the purists: yes, precision is important, but only to a point. If you calculate a takeoff distance of 1,242 feet in high density altitude conditions and the last two feet (or even the last 42 feet) really make a difference in whether you can operate or not, you should stop and consider whether it is wise to fly at all in those conditions. As the saying goes, there are no emergency takeoffs.

Pulling It Together

Now that you understand the parts, let's put it all together. Once you have your weather briefing, start your analysis by focusing on the three big things: wind, ceiling/visibility, and performance issues. Note whether any of these items presents a challenge in any phase of the planned flight.

Next, drill down to the specifics. Review the capabilities of your airplane, and make an honest assessment of your own proficiency. For each weather item — wind, ceiling/visibility, performance issues — you need solid answers to two key questions: Am I up to this challenge? Does my airplane have the capability? If there are any doubts, then you've clearly identified a hazard that you'll need to properly mitigate before you put the finishing touches on a "go" decision.

The bottom line: developing your weather knowledge and expertise is well worth the time and effort you put into it, because truly "getting" the weather will help keep you — and your passengers — safe in the skies. ✈️

Susan Parson (susan.parson@faa.gov, or @avi8rix for Twitter fans) is editor of FAA Safety Briefing. She is an active general aviation pilot and flight instructor.



Photo by Susan Parson

Your Safety Reserve

Developing Your Personal Minimums

Susan Parson

In formal terms, personal minimums refer to an individual pilot's set of procedures, rules, criteria, and guidelines for deciding whether and under what conditions to operate (or continue operating) in the National Airspace System. While this definition is accurate, it tends to describe the product rather than explain the process. Also, the formal definition does not really convey one of the core concepts: personal minimums as a "safety buffer" between the demands of the situation and the extent of your skills.

I like to think of personal minimums as the human factors equivalent of reserve fuel, which is intended to provide a safety buffer between fuel required for normal flight and the fuel available. In the same way, personal minimums should be set so as to provide a solid safety buffer between the pilot skills and aircraft capability *required* for the specific flight you want to make, and the pilot skills and aircraft capability *available* to you through training, experience, currency, proficiency and, in the case of the airplane, performance characteristics. Just as in making fuel calculations, you shouldn't consider making a flight that requires use of skills at the "reserve" or worse, "unusable fuel" level of your pilot-skill and aircraft capability.

Here's one systematic approach to developing your own personal minimums.

Step 1 – Review Weather Minimums. The regulations define weather flight conditions for visual flight rules (VFR) and instrument flight rules (IFR) in terms of specific values for ceiling and visibility. IFR means a ceiling less than 1,000 feet AGL and/or visibility less than three miles. Low IFR (LIFR) is a sub-category of IFR. VFR means a ceiling greater than 3,000 feet AGL and visibility greater than five miles. Marginal VFR (MVFR) is a sub-category of VFR.

Step 2 – Assess Your Experience and Comfort Level. Think through your recent flying experiences and make a note of the lowest weather conditions that you have comfortably experienced in VFR and, if applicable, IFR flying in the last six to twelve months. This exercise helps establish your personal "comfort level" for VFR, MVFR, IFR, and LIFR weather conditions.

Step 3 – Consider Other Conditions. It is also a good idea to have personal minimums for wind, turbulence, and operating conditions that involve things like high density altitude, challenging terrain, or short runways. Record the most challenging conditions you have comfortably experienced in the last six to twelve months.

You can note these values for category and class, for specific make and model, or both.

Step 4 – Assemble and Evaluate. Next, combine these numbers to develop a set of baseline personal minimums.

Step 5 – Adjust for Specific Conditions. Any flight involves almost infinite combinations of pilot skill, experience, condition, and proficiency; aircraft equipment and performance; environmental conditions; and external influences. These factors can compress the baseline safety buffer, so you need a structured way to adjust for changing conditions. Consider developing a chart of adjustment factors based on changes in the PAVE checklist factors - Pilot, Aircraft, enVironment, and External Pressures.

When you have comfortably flown to your baseline personal minimums for several months, you can consider adjusting to lower values. Two important cautions:

- Never adjust personal minimums to a lower value for a specific flight. The time to consider changes is when you are not under any pressure to fly, and when you have the time and objectivity to think honestly about your skill, performance, and comfort level.
- Keep all other variables constant. If your goal is to lower your baseline personal minimums for visibility, don't try to lower the ceiling, wind, or other values at the same time.

Step 6 – Stick to the Plan! Once you have established baseline personal minimums, "all" you need to do next is stick to the plan. That task is a lot harder than it sounds, especially when the flight is for a trip that you really want to make, or when you are staring into the faces of disappointed passengers. Here's where personal minimums can be an especially valuable tool. Professional pilots live by the numbers, and so should you. Pre-established numbers can make it a lot easier to make a smart no-go or divert decision. In addition, a written set of personal minimums can also make it easier to explain tough decisions to passengers who are entrusting their lives to your aeronautical skill and judgment.

Susan Parson (susan.parson@faa.gov, or @avi8rix for Twitter fans) is editor of *FAA Safety Briefing*. She is an active general aviation pilot and flight instructor.



Step 4: Assemble and evaluate baseline personal minimums.

Baseline Personal Minimums				
Weather Condition	VFR	MVFR	IFR	LFR
Ceiling				
	Day			
	Night			
Visibility				
	Day			
	Night			
Turbulence	SE	ME		Make/Model
	Surface			
	Wind Speed			
	Surface			
Wind Gust				
Crosswind Component				
Performance	SE	ME		Make/Model
	Shortest runway			
	Highest terrain			
	Highest density altitude			

Step 5: Adjust for specific conditions.

	If you are facing:	Adjust baseline personal minimums to:
Pilot	Illness, medication, stress, or fatigue; lack of currency (e.g., haven't flown for several weeks)	At least 500 feet to ceiling
Aircraft	An unfamiliar airplane, or an aircraft with unfamiliar avionics/ equipment:	At least 1/2 mile to visibility
enVironment	Airports and airspace with different terrain or unfamiliar characteristics	At least 500 ft to runway length
External Pressures	"Must meet" deadlines, passenger pressures; etc.	At least 5 knots from winds



Federal Aviation Administration

Developing Personal Minimums

Think of personal minimums as the human factors equivalent of reserve fuel. Personal minimums should provide a solid safety buffer between:

- Skills required for the specific flight, and
- Skills available to you through your training, experience, currency, and proficiency.

Step 1 – Review Weather Minimums

Step 2 – Assess Weather Experience and Personal Comfort Level

Step 3 – Consider Winds and Performance

Step 4 – Assemble Baseline Values

Step 5 – Adjust for Specific Conditions

Step 6 – Stick to the Plan!

FOLD

Step 1: Review definitions for VFR & IFR weather minimums.

Category	Ceiling		Visibility
VFR	greater than 3,000 AGL	and	greater than 5 miles
MVFR	1,000 to 3,000 AGL	and/or	3 to 5 miles
IFR	500 to 999 AGL	and/or	1 mile to less than 3 miles
LIFR	below 500 AGL	and/or	less than 1 mile

Step 2(a): Record certification, training, & recent experience.

CERTIFICATION LEVEL	
Certificate level (e.g., private, commercial, ATP)	
Rating(s) (e.g., instrument, multiengine)	
Endorsements (e.g., complex, HP, high altitude)	
TRAINING SUMMARY	
Flight review (e.g., certificate, rating, Wings)	
Instrument Proficiency Check	
Time since checkout in airplane 1	
Time since checkout in airplane 2	
EXPERIENCE	
Total flying time	
Years of flying experience	
RECENT EXPERIENCE (last 12 months)	
Hours	
Hours in this airplane (or identical model)	
Normal Landings	
Crosswind landings	
Night hours	
Night landings	
Hours flown in high density altitude	
Hours flown in mountainous terrain	
IFR hours	
IMC hours (actual conditions)	
Approaches (actual or simulated)	
Time with specific GPS navigator	
Time with specific autopilot	

Step 2(b): Enter values for weather experience/ "comfort level."

Experience & "Comfort Level" Assessment Combined VFR & IFR				
Weather Condition	VFR	MVFR	IFR	LIFR
Ceiling				
Day				
	Night			
Visibility	Day			
	Night			

Step 3(a): Enter values for experience / comfort in turbulence.

Experience & "Comfort Level" Assessment Wind & Turbulence			
	SE	ME	Make/ Model
Turbulence			
Surface wind speed			
Surface wind gusts			
Crosswind component			

Step 3(b): Enter values for performance.

Experience & "Comfort Level" Assessment Performance Factors			
Performance	SE	ME	Make/ Model
Shortest runway			
Highest terrain			
Highest density altitude			



Tough Love

Weather is the most lethal of all major causes of GA accidents ... — Michael Huerta, FAA Administrator

... Mother Nature's performance is capable of overriding forecasts and aircraft specifications ...

— Bruce Landsberg, Aircraft Owners and Pilots Association (AOPA)/Air Safety Institute

We find about 40 percent of [aircraft] accidents, pilots did not get a weather briefing ...

— Earl Weener, National Transportation Safety Board

The link between aviation safety and weather is something that can never be overemphasized ...

— Sean Elliott, Experimental Aircraft Association (EAA)

There are probably a few pilots out there who are a little sick of hearing about weather-related issues within the GA community. After all, if the above quotes are any indication, it would seem that weather is *all* the FAA and its industry partners ever talk about lately. And aren't there more interesting things to talk about instead? Such as 'what are we doing about those drones?' or 'when am I going to get my third class medical relief?' What is the big deal about weather??

"What" indeed.

Answering this question will invariably lead you to the Joseph T. Nall report; a product of the Air Safety Institute that summarizes the numbers of GA accidents, fatal accidents, and fatalities during the past two years, and includes tabulations of the categories and classes of aircraft involved, pilot qualifications, purposes of the accident flights, and light and weather conditions. The report is often a sobering read because even though the aviation industry as a whole is remarkably safe, general aviation has flat-lined, showing little progress over the last several years. In fact, GA safety rates are now featuring as "public enemy number one" on the NTSB's "most wanted" list. Not a covetable achievement.

And while there are several accident-causing categories the NTSB has targeted for GA to improve upon (<http://go.usa.gov/ezaV>), when it comes to *lethality*, those mishaps attributed to weather rise to the top with a staggering 65 percent resulting in fatalities.

65 percent.

Taken from the 2012-2013 Nall Report with pertinent passages bolded for emphasis:

*Not surprisingly, almost three-quarters of all weather accidents took place in instrument conditions and/or at night. However, **lethality was at least 50% in all conditions**, including daytime VMC*

***Private pilots made up about two-thirds of those involved in identified weather accidents**, while only 30% held commercial or airline transport pilot certificates. More than half of all pilots in known weather accidents held instrument ratings, including 16 of the 28 in fatal accidents, but flight instructors were on board fewer than one-eighth of the accident flights....*

*Some more snippets: "Fatal weather accidents are among the most difficult to investigate, and weather accidents are the **most consistently fatal**." "Available data do suggest that, as always, **attempts to fly by visual references in instrument conditions** accounted for the lion's share of fatalities."*

And last, this little take-away from the report spoke volumes in particular: "Accidents caused by fuel mismanagement or adverse weather generally give reasonable warning to the pilot. As such, they can be considered **failures of flight planning or in-flight decision-making**."

That is why the "big deal" about weather. As a whole, we simply have to do better. We are failing to recognize the danger presented before us when considering flight into potential adverse weather, and we are failing to adequately plan to mitigate that risk.

Some of this is the responsibility of the FAA. With the help of some industry powerhouses such as AOPA, EAA, General Aviation Manufacturers Association, and the Helicopter Association International, the FAA has amped up weather awareness and education to a whole new level and this weather-themed edition of *FAA Safety Briefing* is just one part of an ongoing outreach program.

In coordination with the National Oceanic and Atmospheric Administration's National Weather Service, the FAA is also working to ensure consistent, timely, and accurate weather information for domestic and international airspace. Armed with better understanding and the appropriate weather forecast,

(continued on page 35)



Whether the Weather is Right

Aeronautical Decision Making and Weather Resources for Helicopter Pilots

A typical day in the life of a helicopter pilot is anything but typical. Unlike airplanes that fly from point A to point B, “point B” for a helicopter might be a rooftop, an accident scene in the middle of nowhere, or a helipad protruding from the middle of the ocean. Because of these unique destinations, helicopter pilots must be able to handle dynamic situations on the fly, which includes unknown or rapidly changing weather conditions.

Regardless of experience, all pilots face the same challenging and often unpredictable conditions delivered by Mother Nature — conditions that should never be taken lightly.

FRAT Party

Helicopter pilots should take immediate action should they encounter unexpected weather conditions. If the weather starts getting crummy, there’s a high probability conditions will get worse before they get better. One simple resource available in deteriorating weather conditions is called a “trigger-point.” According to this philosophy, when pilots find themselves in deteriorating conditions requiring them to reduce airspeed by a pre-determined amount in relationship to normal cruise speed, they have reached a “trigger-point.” At trigger-points, pilots are encouraged to land, turn-around, or change direction in order to break this potential accident chain.

Risk management, prior to and during flight, plays a critical role in maintaining safety, especially when weather is a factor. One tool available to all pilots is a Flight Risk-Analysis Tool (FRAT). Although helicopter air ambulance pilots are most familiar with FRATs because of regulations, their use can enhance safety in all segments of the rotorcraft industry. In essence, a FRAT enhances situational awareness for crew members in even small, seemingly innocuous situations. A FRAT serves as a simple reminder that every flight has some degree of risk and can help reveal previously unseen hazards.

Unfortunately, some aspects of weather awareness and risk management training can be neglected during the early phases of primary flight training. Although student pilots have to absorb a lot when learning to fly, flight instructors must emphasize the importance of weather knowledge and risk management from the very first flight. More flight schools are

utilizing standardized risk assessment tools on their training flights as they recognize that building a successful safety culture starts on day one.

HEMS Weather Tool

The Helicopter Emergency Medical Service (HEMS) Weather Tool is a terrific system used by helicopter pilots to gain awareness of weather conditions in between certified reporting stations. This tool is specially designed to help meet the weather forecasting needs of low-altitude VFR helicopter air ambulance first responders. The HEMS Weather Tool overlays multiple fields of interest: ceiling, visibility, flight category, winds, relative humidity, temperature, radar (base and composite reflectivity), AIRMETs and SIGMETs, METARs, TAFs, and PIREPs in a 3-D format interpolated to AGL altitudes for enhanced perspective on what weather might be expected at the destination.

Currently, the HEMS Weather Tool operates on an experimental Aviation Digital Data Service (ADDS) platform, maintained by the National Center for Atmospheric Research in Boulder, Colorado, but soon should be fully operational with 24/7 support with limited restrictions. The tool has high-resolution base maps, including colored elevation contours, streets, hospitals, airports, and heliports for the entire United States. Preferred views can be saved for quick recall later and automatically updated with current data.

Take Action

Most pilots would agree that weather is never truly static. It can change without warning, leaving pilots shaking their heads in disbelief. To help mitigate this uncertainty, safety professionals from the United States Helicopter Safety Team have provided free resources for making flying enjoyable and safe on their website at www.USHST.org.

As we head into the spring flying season, be mindful of changing weather conditions. Always have a plan B and don’t be afraid to act on it should you become uncomfortable. Remember, it’s better to be on the ground wishing you were in the air versus wishing you were safely on the ground. When in doubt, keep your helicopter skids planted firmly on the surface and wait things out. It’s as simple as that.



Flight Forum

High Flying Kites

We have a situation where a person is flying kites above 100 feet. The kites are off the departure end of one of our runways and they are tethered and not manned. A helicopter almost hit the kites at night. What are the rules and is there anything we can do to ensure safety?

— Mike

Thank you for your question. Moored balloons, kites, amateur rockets and unmanned free balloons are covered by 14 CFR part 101. In particular, read sections 101.1 through 101.19, with focus on 101.13, 101.15 and 101.17. It can be found here: <http://go.usa.gov/Fe5B>. Again, thanks for your concern.

Winter Ops Kudos

FAA Safety Briefing usually does a great job, as we approach winter, reminding us of the hazards of winter operations. We keep a copy of a Safety Briefing in the plane published several years ago and use it to start our “winter ops briefing” about this time every year. Flying into Erie with lake effect snow any time after Halloween is an exercise in risk management!

— Drew

Thank you for the kind words! Several of our readers have reported keeping their favorite “go-to” copies handy to refer back to when they need it. We are particularly happy that you are using this useful tool to jumpstart your safety discussions. Hopefully we can keep adding to your reference library in the future.

It's a Heavy Issue

Great article. [You Can't Take All That!] July/August 2014 edition] I just had an issue, recently, when I let my neighbors know I'd fly their kid down to a summer program in Tampa, FL, from Summerville,

(Angle of Attack continued)

it is our hope that we finally see positive movement from the safety needle.

But regardless of how much information is pumped into the National Airspace System (NAS) and no matter how many new gadgets, gizmos and preventative techniques are concocted to aid in risk mitigation, it all comes down to you, the pilot. We need you to do better, too.

This may mean taking that extra bit of time to request and carefully scrutinize the latest weather and radar report. This may mean taking a moment

SC. It's a nine-plus hour drive, but in my AA-5A, only a three hour flight. People just don't see GA planes that much, so his original “suitcase” had to be swapped for a duffel bag. Flying him and his Dad with a bag was fine for the weight & balance, but then when Mom decided she wanted to go too, I had to give her the choice of her or Dad, but not both, explaining small planes just don't have the power or size.

— JT

This is exactly why we thought an entire edition dedicated to “those that fly with us” was an important undertaking. A lot of people might not understand the aspects that divide GA versus commercial aircraft with weight and balance being one of the biggest differences. We are happy to hear you were able to help your neighbor out and stay safe while doing so!

FAA Safety Briefing welcomes comments.

We may edit letters for style and/or length. If we have more than one letter on a topic, we will select a representative letter to publish.

Because of publishing schedule, responses may not appear for several issues. While we do not print anonymous letters, we will

withhold names or send personal replies upon request. If you have a concern with an immediate FAA operational issue, contact your local Flight Standards District Office or air traffic facility. Send letters to: Editor, FAA Safety Briefing, AFS-850, 55 M Street, SE, Washington, DC 20003-3522, or e-mail SafetyBriefing@faa.gov.



Let us hear from you — comments, suggestions, and questions: email SafetyBriefing@faa.gov or use a smartphone QR reader to go “VFR-direct” to our mailbox.

to self-analyze (and accept) your own limitations. It might even mean delaying or foregoing that eagerly anticipated family trip. And the end result of all of these efforts might mean a gloriously boring future Nall report.

I look forward to reading that one.

Sabrina Woods is an associate editor for FAA Safety Briefing. She spent 12 years as an aircraft maintenance officer and an aviation mishap investigator in the Air Force.

Gone, but Not Forgotten

If your contribution has been vital there will always be somebody to pick up where you left off, and that will be your claim to immortality. — Walter Gropius

One of the quirky ways that we humans honor the accomplishments of a fellow being is to give that person's name to his or her achievement, invention, or discovery. In so doing, we bestow a kind of immortality, although usually the name lives long after virtually everything about the person has largely been forgotten.

In researching for this issue of *FAA Safety Briefing*, I stumbled across stories of several of the people behind the terms so casually bandied about in any discussion of weather. Allow me to introduce them as we close this weather-focused edition.

What's the Temperature?

Thanks to the work of these intrepid gentlemen, today's weather-watchers have several ways to express the degree (so to speak) of heat or cold.

Celsius: A Swedish scientist, Anders Celsius (1701-1744) developed the Celsius temperature scale, which he himself called "centigrade" because it was developed on a scale of 0° for the freezing point of water to 100° for its boiling point.

Fahrenheit: In addition to inventing the temperature scale that bears his name, German scientist Daniel Gabriel Fahrenheit (1686-1736) invented the first mercury thermometer contained in glass. Fahrenheit developed his temperature scale by reference to three fixed points: 0°, 32° (ice forming on the surface) and 96° (thermometer's reading when placed in the mouth).

Kelvin: William Thomson, the first Baron Kelvin (1824-1907), was a British mathematical physicist and engineer. Although the existence of absolute zero was known during his lifetime, Kelvin is credited for determining its exact value (-273.15 C, or -460 F.). For this reason, absolute temperatures are expressed in units of kelvin.

As the World Turns ...

Coriolis Effect: French engineer and mathematician Gustave-Gaspard Coriolis (1792-1843), was the first to describe the effect of motion on a rotating body in an 1835 paper. Today known as Coriolis force, this effect is important to understanding meteorology.

Doppler: The Austrian mathematician Christian Doppler (1803-1853) is best known for his 1842 paper which theorized that the pitch of sound from a moving source varies for a stationary observer. The "Doppler effect" is used in weather forecasting, radar and navigation.

Fujita: Tetsuya Fujita (1929-1998) is famous for developing the "Fujita scale" for measuring tornado intensity. For pilots, he may be best remembered as the scientist who discovered downbursts and microbursts. Fujita's research led to the development of pilot training to avoid or escape these phenomena.

Saffir & Simpson: Herbert Saffir (1917-2007) and Robert H. Simpson (1912-2014) devised the 1-to-5 "Saffir-Simpson" scale that forecasters use to describe the severity of an oncoming hurricane. Saffir, an engineer, had written building safety codes in Florida before being asked to develop a hurricane-preparedness model for the United Nations. Saffir's scale, based primarily on wind speeds, was later expanded by Simpson, then director of the National Hurricane Center, to include potential storm surge.

People We Ought to Know

Dalton: John Dalton (1766-1844) was a British scientist who theorized that all matter is made up of small particles ("atoms"). Dalton also loved weather and he created his own instruments to record his weather observations. The data he gathered on humidity, temperature, atmospheric pressure, and wind through 57 years built the foundation for weather recordkeeping.

Wegener: German scientist Alfred Wegener (1880-1930) was most famous for his theory of continental drift, but he had a lifelong interest in meteorology. Wegener was the first to use balloons as a means to track weather and air masses. Wegener died on an expedition to study the circulation of polar air in Greenland, part of his attempt to prove the existence of the jet stream.

These are just a few of the notables whose work we enjoy today. We salute them!

Susan Parson (susan.parson@faa.gov, or @aviBrix for Twitter fans) is editor of FAA Safety Briefing. She is an active general aviation pilot and flight instructor.

FAA Faces

Jeanne Giering

Director, Flight Service

Flight Service delivery is transforming by expanding the use of existing and developing technologies to provide weather information and filing flight plans — and no one has been witness to this change more than Jeanne Giering, the current director.

A 30-year veteran of the FAA, Jeanne has lived through a lot of the growth and changes that continue to shape the Service. Her extensive organizational memory has helped her to identify where Flight Service needs to go in the future, and is what made her the ideal candidate when she was selected to be director over three years ago.

Jeanne's path to an aviation career was likely cemented when her father would take her out to the perimeter fence of Cleveland Hopkins International Airport in Ohio to watch planes take off and land. There, he would explain each aircraft and their functional capability. Later on, he taught Jeanne some of the weather basics: dew point, cloud formation, and rain measurement, just to name a few. These moments became the foundation for Jeanne to earn her weather observer certificate, and become an employee of the FAA.

Though several amazing assignments and opportunities presented themselves, Jeanne admits that early in her career, "mentorship" was something of a new concept and that people largely relied on their own wits to try and make their way. She feels blessed to have had a manager at the Green Bay Flight Service station, Ron Riley, who went a bit against the grain.

"I would work really hard on a project and bring results I thought were thoroughly researched and he would proceed to take me through a game of 20 questions. 'How did you get to this conclusion?' 'Have you considered the impact this will have on other service units/customers?' 'Would this solution remain sufficient should certain changes happen?' He really helped me to see things from a much broader perspective than just my own cube." Jeanne still chuckles at the memory.

"As a specialist I was so focused on 'doing the operation.' There was so much ownership and pride you almost didn't want to budge. Through his guidance and my collective experiences, I now have a broader perspective and I am the one asking the questions. How can we do things better? How might we incorporate this new technology? How can we better reach the user?"



Jeanne also believes it is important to carry that concept forward with her own team. "Working for the FAA is awesome in that you can do almost anything you want to. There are so many opportunities in so many different areas of aviation safety and policy. You can step into role after role and almost reinvent yourself — taking your knowledge with you from place to place as you grow. But sometimes finding that way can be hard. I want to help teach and mentor others as much as I can to help put my team on the path to personal and organizational success."

Although work takes up a great deal of her time, in those precious free moments Jeanne enjoys reading crime novels — particularly ones written by Patricia Cornwell. She also loves to ballroom dance and visit family, and — being handy with power tools, — is currently dabbling in home improvement. She recently completed revamping her kitchen, and plans to take on other projects like patching drywall and replacing faucets and lighting fixtures. What time is left after those particularly arduous undertakings is devoted to her two mini-schnauzers. When asked what place she has most enjoyed working outside her native Ohio, from her rather expansive list (Cleveland, Ohio; Green Bay, Wis.; Kansas City, Mo; McAlester, Okla; Columbus, Neb.; Washington, D.C.!) she admits that headquarters FAA would be at the top of the list. "In no other place in the FAA do you have such a high and direct level of influence or level of input into policy."

Right now the future is bright for Jeanne Giering and Flight Service. The organization is on the right path to incorporate some of the latest technologies and ensure that they are providing pilots access to the data they need to make good safety of flight decisions.

"It is our ultimate role," she says.



U.S. Department
of Transportation

**Federal Aviation
Administration**

800 Independence Ave., S.W.
Washington, D.C. 20591

FORWARDING SERVICE REQUESTED

Official Business
Penalty for Private Use \$300



faa.gov/news/safety_briefing

faa.gov/news/safety_briefing

@FAASafetyBrief

Look Who's Reading FAA Safety Briefing

Master Flight Instructor and veteran spin expert Rich Stowell turns to *FAA Safety Briefing* to keep straight and level on aviation safety.

